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ORTHODONTICS AS A LIFE FACTOR*

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LANDMARKS

WHEN a child's teeth are where they belong, the child shows the world the face he has inherited, a masterpiece of evolution. When his face has become malformed, the child acquires an unnatural, false appearance. His teeth, out of place, are doomed to premature loss. Decay, faulty digestion, and all the physiologic results of a bad denture will tend to separate him still farther from his full physical heritage.

The individual arrangement of the teeth in the denture and its function as a whole are subject to definite laws; the function of a denture determines again the shape of the individual teeth. This may be ascertained by studying the skulls or dentures of certain types of mammals. These animals, living principally on one kind of food, have highly specialized teeth as to function, which again is reflected in their placement. As an example, the mountain lion (Fig. 1) eats mostly flesh. He seizes his reluctant meal with four powerful canines. His mandible, quite different from the horse's or the human's, is hinged lower than his bite. The stronger the pull forward on the canines, the tighter the jaw closes. The hinge, without lateral movement, broader than the bite, eliminates twist. The human jaw is loose, swinging up and down, back and forth, permitting free lateral movement.

By vertical movement, the lion's mandibular molars become polished on their buccal sides, the blades of the molars becoming sharp as a knife. This action represents the cutting or shearing function of a tooth in one of its most simple forms. This same principle of shearing, whether vertical or horizontal, may be

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observed in animals that prepare food with their molars for the stomach's digestion, as a horse that grinds, or a beaver that triturates his food; or it may be the chewing surface of a human molar with its complex blades.

As the blades of a tooth function in a definite manner, a tooth develops in the jaw in a predetermined spot. The jaw is so hinged as to make the tooth function in a definite path in masticating, all of which has been evolved by evolution. Each tooth has a definite size, form, axial and rotational relation and position in harmony with the architecture of the skull. A properly functioning dental arch as well as each individual tooth should occupy its precise place in three dimensions of space in relation to the skull. Crown, and root form of teeth, and shapes of dental arches vary as do types of individuals, or races, and variations within the races.

Fig. 1.—The skull of cougar or mountain lion.

Architecture placement, shape and bony support of the canines, type of hinge and design of the temporomandibular articulation, length of ramus in coronoid process, size and proportion of muscles of mastication, all harmonize in function contributing to the efficiency of the mechanism in seizing and holding prey. The shearing molar teeth which are used to sever tough and slippery tendons and ligaments are also supported and located in a most favorable position. The jugal buttress covering both roots of the first molar extends upward and backward in a smooth curve coinciding with the curve of the roots of the teeth and the zygoma. Following this curve downward one finds that it also coincides with the distal curve of the mandibular molar roots.

A most valuable principle guiding the orthodontist who conceives his work as a life and health factor is a knowledge of the proper placement of teeth in the skull. His efforts are directed toward maintaining or restoring normal function by moving teeth, reshaping and placing dental arches in their true and most favorable anatomic position in relation to the entire skull.

It is not sufficient to adjust teeth in relation to each other so that each tooth articulates with its opponent while at rest. A tooth also has a functional relation to the skull, to the whole anatomy, as well as to its companions. Only in its place in a normal position in the dental arch may it perform its individual and cooperative functions in a smooth and efficient manner conducive to its

well-being and the health of the individual. In any other position it would be jolted by each stroke of mastication. The peridental membrane would thicken; the tooth, attempting to escape this punishment, would migrate to an unnatural position in the alveolar process. Often a slight migration or rotation from the normal might cause serious damage to the supporting structures.

The tooth itself, unlike any other part of the body, once formed and calcified, can never of itself change its shape. Its roots are supported in bone; however, as long as life continues bone structure constantly undergoes changes. The bone supports, but does not confine, the tooth. Each tooth is maintained in its position by the forces and pressures of its environment: the tongue, the cheek muscles, and all other forces acting upon it.

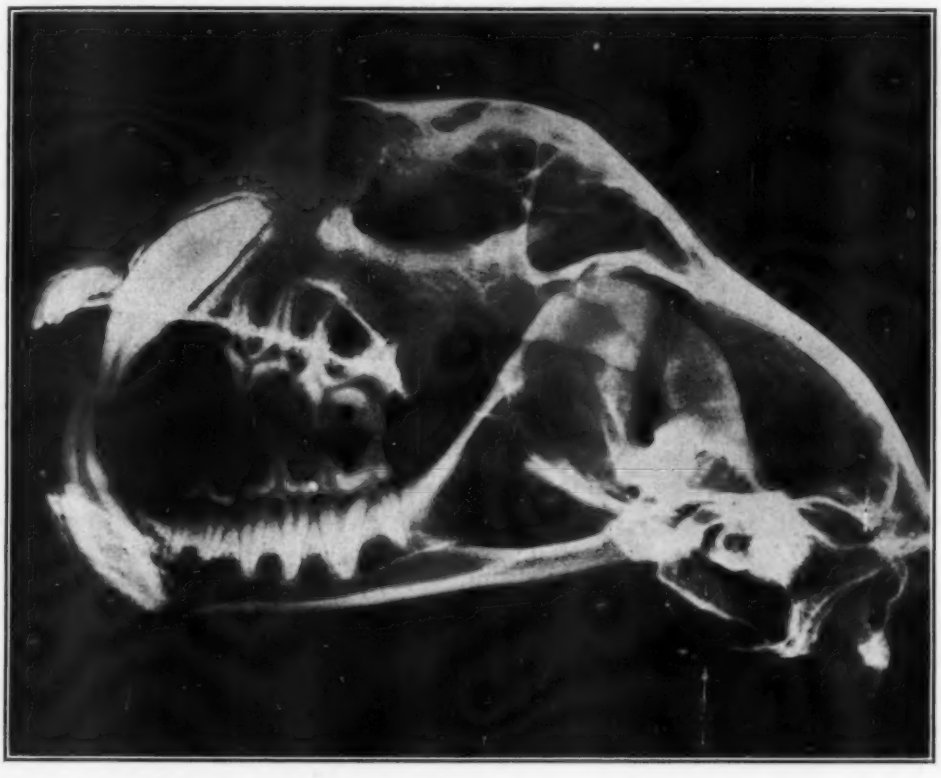

Fig. 2.—Radiograph of skull shown in Fig. 1.

In the radiograph may be observed the beautiful balance between the distribution and direction of cortical bone, size and shape of supported teeth. Note also the even forward and downward curve of the zygoma is continued through the axis of both the maxillary and mandibular molars. This same principle of support may also be observed in man.

The bone supporting a tooth is functional in its structure. On the areas where it would be normal to expect impact, a hard, cortical bone has been evolved by nature to counteract such impact. Where the tooth does not transmit pressure, the bone is relatively soft and spongy, interlaced with fibers acting as tension members. A cross section of bone structure near a tooth shows immediately the normal direction of the chewing pressures. When a tooth drifts out of place, the supporting bone is no longer able to function properly. It is futile to move a tooth to a place where the bone structure is not adequate and where forces cannot be balanced.

In the human jaw the tendency of the teeth is to drift forward. Should a tooth be lost, support removed, this drifting of neighboring teeth is accelerated. These teeth, once forced out of their original position, have not the ability of adapting themselves to the new, unnatural alignment.

Teeth receiving the most punishment during mastication are strengthened by a special reinforcement of the supporting bone. This is a special protective measure of nature developed alike in animals and in men. This bone re-enforcement to which we will pay particular attention in men is a strong buttress of bone descending from the zygoma toward the alveolar process embracing the roots of the maxillary first permanent molar which, with its mate in the mandible, receives the greatest amount of stress during mastication.

In the lion this ridge is especially well developed (Fig. 1). It is divided into two branches which embrace the two roots of the molar re-enforcing them to meet the required function. A radiogram of this area reveals this condition (Fig. 2). In the human, as in the lion, nature's protective measure supports the large molar with a strong, bony buttress which descends downward and forward from the zygoma to the maxillary bone. This buttress is often wide and rounding, covering the roots of the first and second molars. Where the anterior edge of the buttress begins its sharp slope inward and forward to form the canine fossa, there is a distinct ridge of bone which may easily be located by touch or sight (Fig. 3) either clinically or on a dental model. As this ridge lies directly over the mesiobuccal root of the maxillary first permanent molar in an adult, and as this molar formerly was known as the key to occlusion, we have been in the habit of calling this ridge the key ridge. In correcting malocclusion of the teeth this landmark has been found to be of value in determining functionally and esthetically the most desirable location of the dental arches in the skull, harmonizing with individual type. The mathematically minded orthodontist will find difficulty in using this landmark; it can never be said to be found so many millimeters from this or from that point, nor can it be said normally to descend from the zygoma at an angle of a set number of degrees. Distances between points are constantly changing in growing skulls, and as skulls are individually of different shapes various landmarks may not be said universally to be so many millimeters apart. Each patient is to be treated as an individual, not according to an average formula.

One may state as a fact that in all types this ridge descends downward and forward, continuing the graceful curve of the zygoma to cover the mesiobuccal root of the maxillary first molar in the adult. The curve of the mesiobuccal root of the maxillary first molar conforms to the curve of the key ridge. If this curve is continued through the maxillary first molar to the mandibular first, it will be found to conform also to the curve of the roots of the first permanent mandibular molar. In the prognathous type of human as the Australian aborigine the curve of the mesiobuccal root of the maxillary first molar distally is exaggerated as compared to the European, but entirely in harmony with the forward curve of the key ridge and facial profile of the aborigine (Fig. 4). In the nonprognathous or straight-face type the mesiobuccal root of the maxillary first molar is correspondingly vertical (Fig. 5). In the latter type the key ridge descends sharply downward and harmonizes with the straight-face type of

Fig. 3.—California Indian.

The curve of the zygoma, forward and downward, is continued in an even, unbroken line through the long axis of both the maxillary and mandibular first molars. This curve harmonizes with those of the other teeth and facial profile truly expressing individual type. The distinct ridge of bone covering the mesiobuccal root of the maxillary first molar and directly behind the canine fossa, represents the key kidge.

Fig. 4.—Skull of an Australian aborigine.

Note here again the curve of the zygoma in the prognathous type, the curve continues here also in an unbroken line through the key ridge. The excessively curved roots of both upper and lower first molars harmonize with the shapes of the roots of other teeth and facial contour.

Fig. 5.—European straight-face type. Here again the individual curve of the zygoma also descending sharply downward in an unbroken curved line continues through the long axes of maxillary and mandibular first molar. The sharp downward curve of the key ridge again harmonizes with individual type.

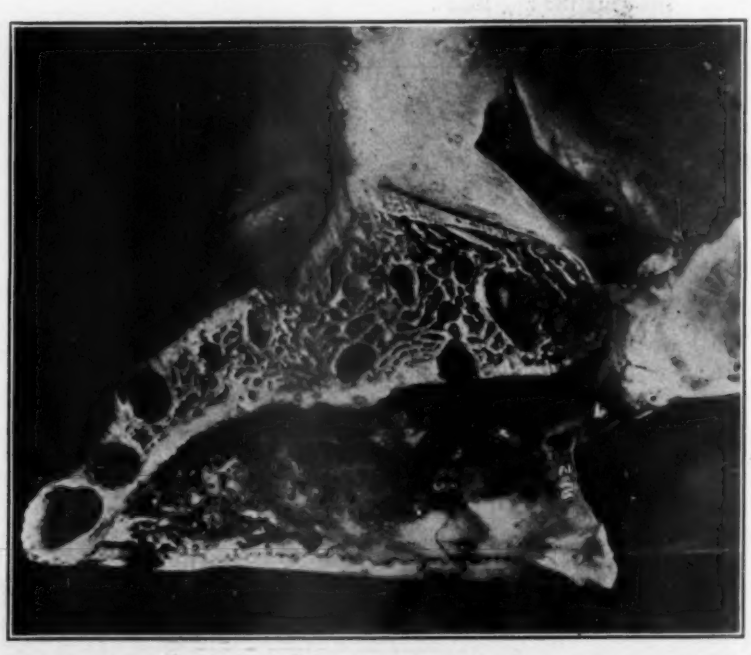

Fig. 6.—Transverse section of maxilla at apical third of the molar roots. The area of cancellous bone between the lingual and buccal plates from the key ridge to the tuberosity has ample width for three-rooted molars. The buccal plate dips sharply inward and forward from the key ridge to form the canine fossa, materially diminishing the space between the labial and lingual cortical plates. This dipping inward of the buccal plate limits the normal forward drift of the molar teeth. The converging of the labial and buccal plates continues to the midline, here they are separated by only three or four millimeters.

individual. In other words the direction of the key ridge and the curvature of the tooth roots harmonize and are true manifestations of individual type. Type is most perfectly expressed in the adult when the mesiobuccal root of the maxillary first molar is directly under this ridge. Such relations of the first maxillary molar to the ridge occur upon the eruption of the third molars. This fact is of the utmost significance to the orthodontist. The key ridge varies with individuals; orthodontists treat individuals, not averages.

This ridge is nothing more or less than the anterior edge of the jugal or molar buttress of the maxillary bone. This ridge also marks the union of the anterior and posterior buccal walls of the antrum of Highmore. The key ridge is clearly indicated from birth to old age whether or not teeth are present.

Fig. 7.—Vertical section demonstrating ample space between the two cortical plates of compact bone to accommodate three-rooted mol ~s (compare with Fig. 8).

Posterior from this landmark the buccal and lingual walls of the maxilla are amply separated to house the three roots of the maxillary molar teeth (Fig. 6). Anterior to this ridge where the buccal plate dips sharply inward to form the canine fossa (Fig. 6), there is not room to accommodate three-rooted teeth. One expects to find the maxillary dental arch so placed that the mesiobuccal root of the maxillary first molar will be directly under the anterior edge or ridge of the jugal buttress. In rare instances where the antrum is diseased the anterior facial wall may be collapsed or otherwise deformed. In such instances the key ridge is also deformed. Nevertheless, the mesiobuccal root still should be under this ridge. The roots of the teeth should at all times be covered with bone. As there is always room buccolingually for three-rooted teeth distal to

the key ridge but not anteriorly, it is safe to have permanent molar teeth placed as above described; or even more distal, where there is room for the molar teeth between the two plates of cortical bone. In arches where there is definite underdevelopment, the extraction of the third molar gives ample room for the remaining two molars under the jugal buttress (Fig. 6). In such a position of the molars the dental arch does not have the appearance of being toothy; the anterior buccal plates of the alveolar process are not thinned out nor injured. Roots of all the teeth are protected and supported by ample alveolar bone. Knowing that the maxillary first permanent molar normally erupts completely within the jugal buttress and distal to the key ridge and does not occupy the position of having its mesiobuccal root under this ridge

Fig. 8.—Vertical section between first molar and second premolar. These two plates continue to approach each other to the midline. From the key ridge forward it is obvious there is no room between the cortical plates to accommodate three-rooted molars.

until full development of the dental arches (Fig. 6), we may assume a first molar to be too far forward of its proper place in the skull if it approaches the key ridge nearer than it should at a given age as previously pointed out. In a horizontal section of an adult maxilla in a plane at about the apical third of the molar roots gives a good idea of the jugal buttress and the key ridge (Fig. 6). The jugal buttress extends from points *A* and *B* to *C* (Fig. 4). The key ridge is located at the anterior crest of the jugal buttress along (D) and (E). Between the cortical bone from the key ridge to the tuberosity on the buccal and the lingual cortical plates of bone there is ample width to accommodate, and strength to support, the large three-rooted molar teeth. Within this area is their natural location. Anterior to the key ridge the buccal cortical plates of

bone converge; gradually approaching the lingual plate, the cancellous space between becomes narrow until at the midline the two plates of bone are but about three to four millimeters apart.

Vertical sections give the same information (Fig. 7); the section above is made through the key ridge and below through the canine fossa. In Figs. 3

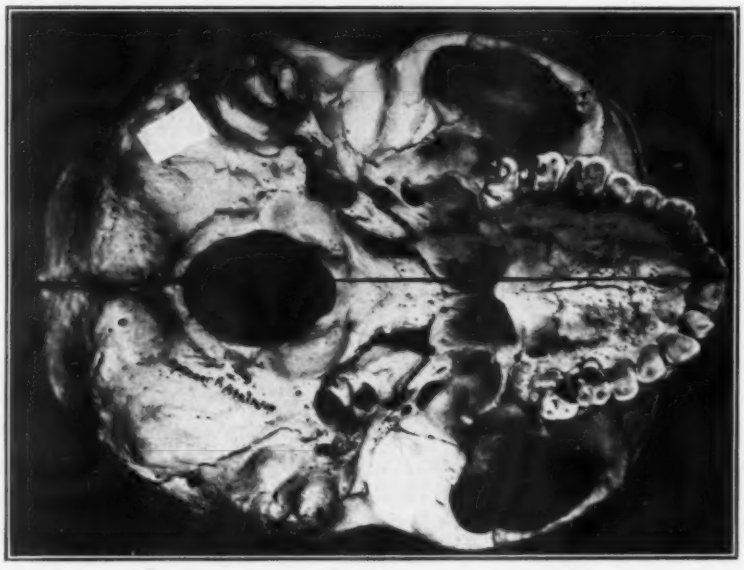

Fig. 9.—Base of skull with curved midline not infrequently met with. The key ridge, the mandibular fossa, the occipital bone as well as the mastoid process of the left side are considerably forward of those on the right. The base of the sphenoid has developed asymmetrically. Such conditions may mar the patient's face, esthetically, to a considerable degree, but may in many instances be prevented; however, if of long standing and well developed they obviously are out of orthodontic influence.

Fig. 10.—Exposed root of the first maxillary molar which has drifted into the canine fossa. Root surface is deeply resorbed by osteoclastic activity. The mesial root, being more forward than the distal, has suffered to a greater extent.

to 6 the powerful support the maxillary arches receive in a lateral as well as vertical direction from the jugal buttress may be noted, and also the way in which the key ridge follows the even curve of the zygomatic process in its downward and forward direction. It is not to be understood that a line joining identical points of opposite key ridges would be at right angles to a line bisecting the skull along the midline. Such is rarely the case. Seldom do we see a perfectly symmetrical skull. Very few skulls have a midline which is straight, the midplane is more often curved; in such a case the key ridge of one side, together with all neighboring structures will be more forward than that of the other side of the skull, depending on whether it is on the convex or concave side of the curved midplane (Fig. 8). In such cases the molar teeth have not changed their relationship to the key ridge; the entire skull is distorted. This can be ascertained by examining the skull from below (Fig. 8).

Such a distortion, however, is of no moment in orthodontics as the midline concerns orthodontists only as related to the facial bones and dental arches. But, on the other hand, the buccal teeth or the entire complement of teeth may drift or migrate forward without influencing the position of the key ridge to the skull. Should the molar teeth drift forward of their normal position into the area of the canine fossa where the buccal and lingual cortical plates converge, then the mesiobuccal root of the first molar usually protrudes through the cortical plate of bone in the canine fossa (Fig. 9) covered only by the mucous membrane. This exposed portion of tooth root is by no means uninjured. Osteoclastic action is not only active in the immediate surrounding cortical bone, but also attacks the cementum of the tooth root as is seen in the deeply honeycombed condition (Fig. 10). Many of these resorptions extend almost to the pulp. The tooth partly deprived of its proper support is in a weakened condition. It will drift at a more rapid pace and ultimately the covering soft tissue will break down, exposing the root.

(To Be Continued)

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SIGMATISM AND MALPOSITION OF THE TEETH

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FOR a considerable time there has been a difference of opinion as to the relation between defects of speech and malposition of the teeth. Sigmatism is of most obvious interest, since, as Fröschels said, the S sound has the smallest physiologic breadth; in other words, the slightest modification in the physiologic conditions governing the production of the S sound is sufficient to render the articulation of this sound indistinct or even false. Literature contains reports on topics connected with this, and authorities such as Nadoleeny, Fröschels, Barczynski, Weiss, Harold, and Bramer have attempted to throw light on this question.

In undertaking to explain the interplay of two phenomena, sigmatism and malposition of the teeth, I must first draw attention to the origin of the orthodontic affections, whose nature and mechanism have been revealed more fully through recent research. This does not, however, indicate taking a specific one-sided attitude toward the problem. The question must be considered from an angle which will show, in this case as elsewhere, that the correct solution of medical problems is to be obtained only from correlation and cooperation between the various branches.

Nature already discloses her aim in the development of the jaw condition in the embryonal months, leading finally to the establishment of the distal bite of the newborn infant. This is a jaw position which cannot be called normal either in children or adults. When heredity and environment are normal, then the functional stimuli which come into action will ensure a normal development. Korkhaus has described in a comprehensive report how malformations of the jaw arise and has crowned this piece of work with his study of twins. It is revealed that protrusion (Angle Class III) and overlapping teeth (Angle Class II) are deformities, depending to an especial degree on heredity, and are related in some way to each other. In both cases the maxillary incisors are sharply inclined, and these abnormalities are rarely found in our patients. The most frequent phenomenon found in the children is the narrow-bite due to environment, with or without distal bite. These bone arches, being mostly affected by rickets, are easily bent, and it is no wonder if the position of the milk teeth, and thereby the curve of the jaw, is altered by sucking the feeding bottle or "pacifier." The same is true of the next group which we often find, the open-bite, which reveals normally placed, protruding or crowded anterior teeth. Rickets is a contributory cause in many of these conditions, and the environmental factor is the feeding bottle. A direct hereditary influence is unlikely. The cross-bite, which we find fairly frequently in case of lateral sigmatism, must also be taken into account. Orthodontists are well aware that in speaking and eating, the teeth may be displaced by intermittent motions of the tongue, especially in

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jaws affected by rickets. Of course, we must not allow ourselves to be misled into attributing a one-sided cross-bite arising from the patient's position when asleep or from some mishap at birth, to pressure of the tongue. This anomaly is recognizable by the complete overlapping of the maxillary deciduous molars over the mandibulars.

Actually in a large proportion of our patients we find the neutral-bite, with all its consequences, caused through premature loss of teeth or insufficient attention. It is seldom that we come across a normal jaw with a fully normal row of teeth. These conditions do not, however, necessarily point to a causal connection between abnormality and sigmatism, for on the one hand the fact that so many children have defects of the jaw without any impediment in their speech and on the other the known existence—although rarely seen—of a completely normal neutral-bite accompanied by abnormalities of speech, point to the conclusion that such anomalies are secondary conditions. It must also be recalled that sigmatism can be cured without modification of the teeth.

If deformities are evident in almost all children of the poorer classes, special reasons for this are to be found in their environment. The parents, and especially the mothers, showed physical exhaustion brought on by the war and the years following, and they were therefore unable to breast feed their children. The artificial feeding thus rendered necessary, in addition to rickets, was sufficient to cause these affections.

We must, therefore, look for other reasons for the association of the two symptoms, and I now come to the conclusions which were my guiding principles for researches in the family history of the individual children. I leave out of consideration those cases in which a similar defect of speech is to be found in the parents, brothers and sisters, or other persons in contact with the children. In such cases it is difficult to doubt that the defect is imitative (Gutzman, Fröschels). The explanation of the origin of the sigmatism in the remaining children is by no means so easy.

The following points must be considered. The cooperation between certain organs or groups of muscles is a priori not anatomic but functional. Such muscles are only coordinated for a specific purpose through phylogenesis and ontogenesis.

Let us make this clear. Man is born with two phenomena of coordination. These are breathing and sucking. For both phenomena certain muscles are innervated; they are already coordinated. Excepting these two phenomena, coordination can only be learned through self-experimentation. That is fundamental. Every newborn child uses each eye separately. Later on, the child learns to focus and coordinates certain muscles to make both eyes function together. Or, the small child who at first cannot assume a sitting posture without the support of his abdominal viscera, changes the form of his spine by the nature of his movement in his environment. In other words, the spine of a newborn child lasts only so long as it is a quadruped. The spine when it is straightened, acquires a definite form. This procedure is only possible by collaboration of certain muscles which are coordinated. They also enable the child to hold his head erect, a phenomenon learned as one of the first coordinations by self-experimentation.

Let us go to adults. The leg muscles which were originally correlated for walking in an upright position can be used for riding or cycling. It is true that the new coordination must be learned. Or normally, when opening the mouth we combine the hinge movement in the jaw articulation with a forward thrust of the mandible. We can, however, learn to open the mouth without thrusting the mandible forward. The coordination of the hinge and the thrust movement is, therefore, purely a matter of innervation and not the inevitable consequence of anatomic conditions.

If a defect of speech is regarded as a psychic symptom, we must endeavor to give reasons for the appearance of this symptom. The explanation lies, or so I see it, in the manner in which the infant is fed. Normal coordination of the lips, tongue, and mandibular muscles in a certain manner takes place when the infant sucks at the breast. An innervation complex arises as a consequence, and is "prepared," as the psychologist says. This special kind of innervation also comes into practice in the enunciation of certain sounds. It can, therefore, easily be understood that a bottle-fed child will learn a special, but not a natural, kind of innervation. If the child becomes neurotic, this innervation is put forward as a basis for the appearance of a defect of speech, as a neurotic symptom. This coordination, which departs from the normal and was predetermined, leads to abnormality. In these children the false coordination complex is not consciously chosen; it is already there and is taken over.

In order to support this contention we must undertake a comparative analysis of the process taking place in sucking at the breast and in the formation of the S sound on the one hand and of what occurs in the case of bottle feeding and in the origin of the sigmatism on the other hand.

When the S sound is formed, the mandible is raised on account of the parting of the lips (Fröschels), the tip of the tongue is placed on the maxillary or mandibular teeth, and the tongue itself lies flat in the mouth and forms a groove in the anterior portion. The air rushes down this, using the edges of the incisors as friction resistance.

Let us compare this with sucking at the breast. It should be remembered that in the infant, when the mouth is closed, the tongue when at rest lies on the palate, in order to fill up the mouth area. In swallowing, the base of the tongue, the floor of the mouth, and the mandible are automatically lowered. This gives rise to a vacuum, without which sucking out from the nipple would be impossible. In infants this process is aided by the *corpus adiposum buccae*, called the Bichat pad of fat, which lies on the outside of m. buccinatorius, and which prevents the sucking-in of the cheek. The sucking child embraces the nipple with the lip muscles. The mandible is lowered by cooperation of the muscles pterygoid externus, anterior belly of digasticus, m. mylohyoid, and geniohyoid. It is thrust forward and finally raised by the muscles (masseter, temporalis, pterygoid). Through this muscle activity, development of the bones is stimulated and the normal structure of the skull is prepared. The forward thrusting of the mandible is supposed to remove the physiologic distal bite of the newborn infant from our ken, and together with the lowered tongue produces a negative air pressure in the mouth. As is known, this is required to counterbalance the positive pressure in the nose, in order to render possible the normal development of

the palatal arch. The milk is sucked out of the nipple in such a manner that the mandible, in sliding out of its forward thrust position, makes use of the maxilla as resistance and presses down the nipple in sliding over it. It is therefore clear that the normal sucking process stimulates the muscles of the face and throat and the future speech muscles into physiologic activity.

The bottle-feeding process is completely different. It is a mechanical sucking. The infant presses the tongue against the entire palatal surface of the maxilla, or against its anterior lingual border, and presses the milk out of the nipple. Here there is no muscle action; indeed, the anterior portion of the maxilla is pressed forward by the tongue, thus giving rise to these numerous deformities.

In sigmatismus multilocularis and interdentalis the tongue is pressed against the incisors, and there is no groove through which the air can escape. The fact that, as in bottle feeding, the tongue has a forward movement is confirmation of the relative weakness of the retractors, which is probably brought on by the exercising of the protractors.

At the Clinic of Professor Heinrich Neuman (Vienna), department of Professor Emil Fröschels, I examined dentally 210 children who had multiloculism or interdental sigmatism. Of these, 139 were fed by bottle, 30 by breast and 41 on mixed feeding. In the latter it is to be noted that breast feeding lasted from four weeks to nine months.

I now express the conjecture that the tendency, evident in cases of multiloculism and interdental sigmatism, to thrust the tongue too far forward is probably due to the same impulse as in bottle feeding, particularly as the common abnormalities, which are evident in the forms previously spoken of, may be attributed to the same cause in bottle feeding.

EMBASSY, 21 STREET AND WALNUT

A COMPARATIVE STUDY OF ROOT RESORPTION IN THE HUMAN AND THE CAT

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IT IS probable that long before the dawn of civilization our primitive ancestors observed the shedding of the deciduous teeth. Perhaps the Greek philosophers originated the theory that the first set of teeth were mechanically pushed out of their sockets by the teeth which replaced them. Whatever its source, this opinion prevailed until the time of John Hunter, to whom Hopewell-Smith has aptly referred as the "founder of the science of comparative odontology."

Hunter,[1] in his classical treatise published in 1771, refuted this widespread opinion and substantiated his statement that "the change is not produced by mechanical pressure but is a particular process in the animal economy." Constant,[2] in 1900, in a report read before the Third International Dental Congress stated that blood pressure might be the impelling force responsible for the eruption of teeth. Tomes[3] gave a good account of the events occurring during the shedding of the first set of teeth, but pointed out that the process was imperfectly understood. In 1930, Hopewell-Smith[4] gave an excellent discussion of the entire problem.

During the progress of a previous investigation on the shedding of teeth in the cat,[5] it occurred to us that a comparative study of this problem in the human and the cat would be of interest. At least one factor influencing the shedding of the deciduous tooth could be tested experimentally, namely, the presence of the developing permanent tooth germ. We devised methods for testing this influence.

It had been shown previously by Jayne[6] and Shapiro,[7] that the order of the development of the teeth in the cat is similar to that of the human. The sequence of eruption and the order of completion of the dentition are comparable. The resorption of which we speak is a normal process of development, and is to be differentiated from that which might be caused by such extrinsic influences as the movement of teeth by mechanical appliances. We will present radiographic and microscopic material of developing dentition in both the human and the cat.

In the human the radiographic study is based upon x-ray pictures of normally developing teeth in the child, and in clinical cases which demonstrate congenital absence of permanent teeth in the adult. In the cat the radiographic study is based upon pictures of our experimental animals: The microscopic study is based upon human material (from sources mentioned in the text) and from histologic sections made from our animals.

Fig. 1 contains four radiographs of the developing dentition of a child aged 6½ years. Figs. 2, 3, 4, and 5 are a number of x-rays of the developing

Read before the New York Society of Orthodontists, New York City, March, 1939.
From the Department of Anatomy, Columbia University, New York.

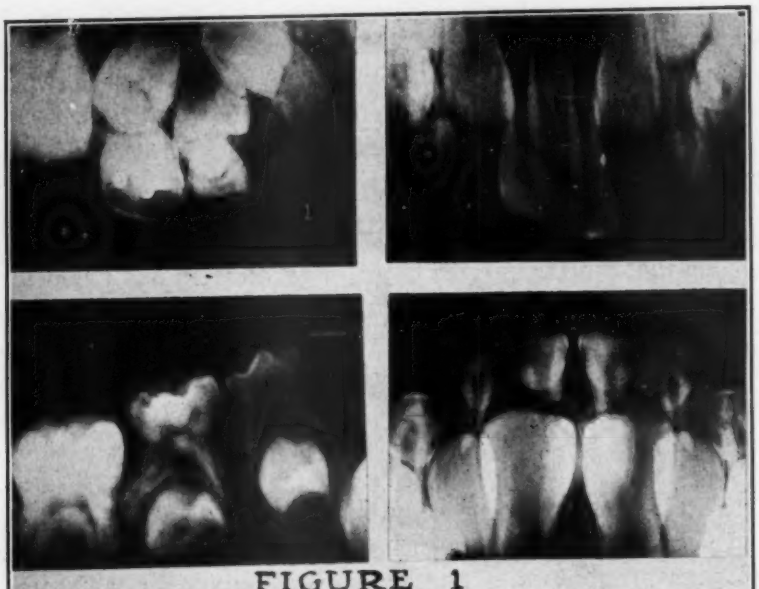


FIGURE 1

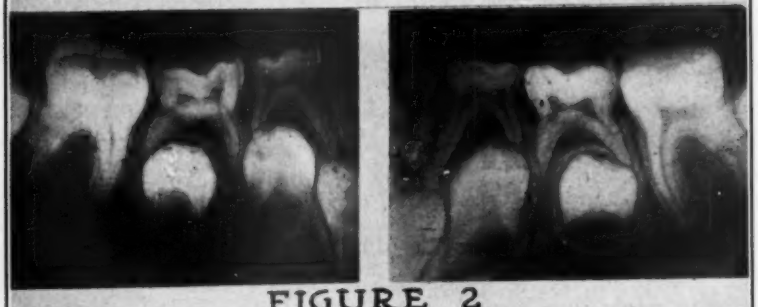


FIGURE 2

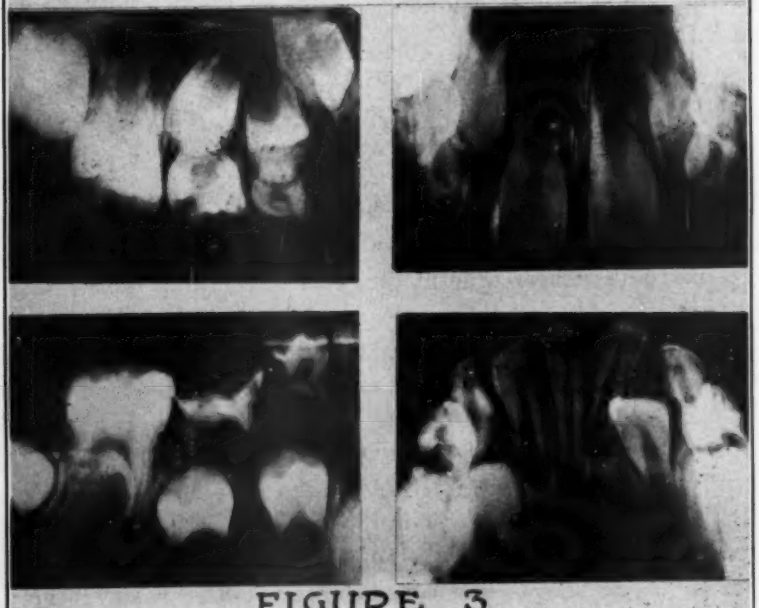


FIGURE 3

Figs. 1 to 3.

FIGURE 4

FIGURE 5

Figs. 4 and 5.

dentition of children aged 7, 8, 9, and 11 years, respectively. These radiographs of the dentition in the growing child illustrate the progressive resorption of the deciduous roots and the development and completion of the underlying permanent teeth; they are comparable with those of the dentition in the cat.

Figs. 6 and 7 consist of radiographs of clinical cases in which permanent tooth germs are congenitally absent. It will be observed in each case that resorption of the roots of the retained deciduous teeth is in progress, though no permanent tooth germs are present in the jaws.

RADIOGRAPHIC TECHNIQUES AND PROCEDURES

Radiographs of the kittens were taken as soon after birth as possible. Fig. 8 is a radiograph of a pregnant cat. Fig. 9 is a radiograph of a newborn kitten, at the earliest postnatal period with the placenta still attached.

Fig. 10 demonstrates the manner in which the kittens were immobilized for x-ray exposures. They were carefully wrapped in a cloth and were either held in the hand or placed in a hinged box, so that movement of the animal could be controlled during x-ray procedures. A small intraoral film was attached to the forefinger of one hand by means of an elastic band, and the kitten was held in the other. The finger with the film attached was inserted into the mouth, and the picture was taken. Fig. 11 demonstrates how readily the animals became conditioned to daily oral examination.

We devised an operation which we shall describe briefly. The permanent canine tooth in kittens was selected for study because of its accessibility and large size. The germ was removed on one side of the mandible, and the unoperated side served as the control. An incision was made along the inferior border of the mandible, beginning at the symphysis, and continued posteriorly about three-fourths of an inch, and the skin was retracted. The incision was then extended through the fascia and periosteum, exposing the bone. With a small surgical burr, a window was cut through the outer alveolar plate below the apex of the root of the deciduous canine tooth, the position of this tooth having been determined by preoperative radiographs. The hooked end of a dental explorer was then inserted through the opening in the bone and the developing permanent canine tooth germ carefully removed, so that no injury occurred to the surrounding tissues. The edges of the cut bone were then smoothed, the tissue and skin sutured, and postoperative radiographs taken. Fig. 12 is a drawing of the area of operation.

Fig. 13 is a series of radiographs of one of our operated animals, a kitten aged 14 weeks, which shows in *A* the preoperative, and in *B* the postoperative picture. It can be seen that the operation has resulted in no injury to the deciduous canine root. The radiographs *C* and *D* demonstrate progressive development of the permanent teeth and the order of the resorption of the deciduous incisor teeth. The incisors are shed in a sequence quite similar to that of the human. The first incisor is resorbed and shed, after which the second and third incisor teeth are shed in order, the dentition of the cat consisting of three incisor teeth on each half of the mandible as compared with two in the human. After the shedding of the third incisor, evidence of the

FIGURE 6

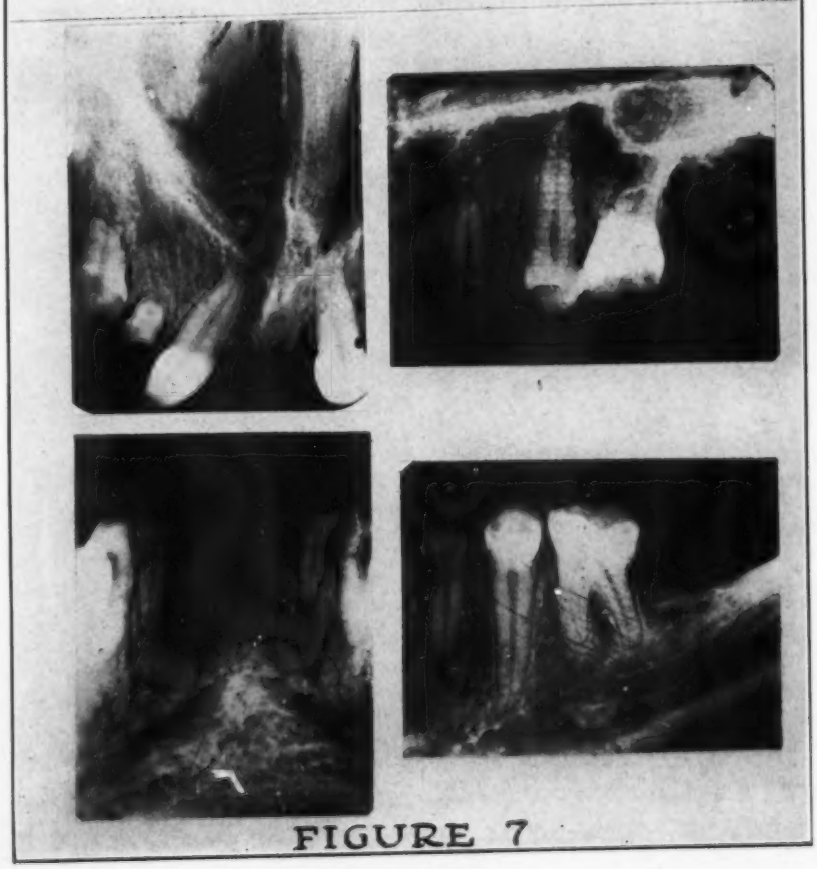


FIGURE 7

Figs. 6 and 7.

FIGURE 8

FIGURE 9

FIGURE 10

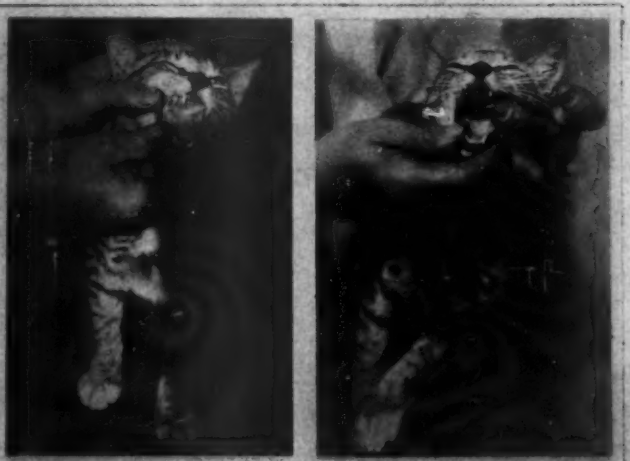


FIGURE 11

Figs. 8 to 11.

beginning of resorption of the root of the deciduous tooth on the unoperated side can be observed *(E)*. At a later stage *(F)* resorption of the deciduous canine tooth on the operated side may be observed, and this progresses as shown in *G* until the deciduous canine on that side is about to be shed as shown in *H*.

Fig. 14 is another series of pictures of a litter mate of the first kitten, and a similar progressive history of development and resorption of teeth is shown. The third series of pictures (Fig. 15) is of a kitten aged 22 weeks, in which the radiographic study is shortened because of the more advanced age of the animal at the time of operation. Fig. 16 shows comparative radiographs of the teeth of human and cat. *A* and *B* are radiographs which demonstrate resorption of the deciduous canine teeth in two of our experimental animals in which the permanent canine tooth germs had been removed. *C* and *D* show comparable resorption of deciduous teeth in the human where there is a congenital absence of permanent tooth germs.

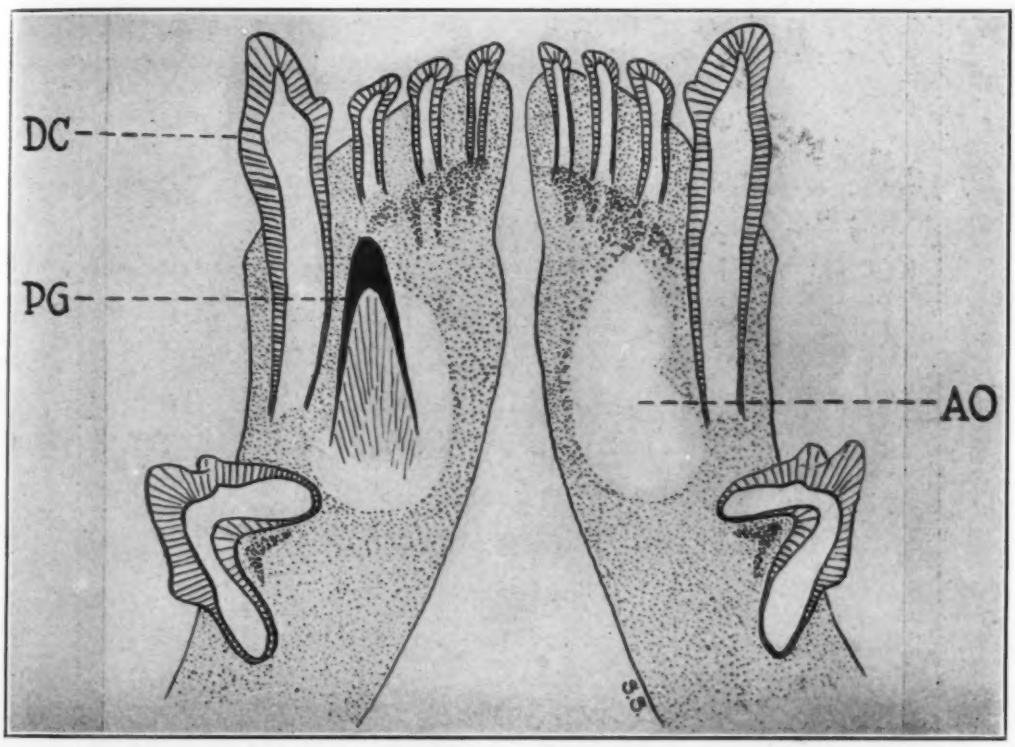


Fig. 12.—Diagram from a postoperative radiograph taken immediately after removal of the permanent canine tooth germ on one side of the mandible of the cat. *DC*, deciduous canine; *PG*, developing permanent canine tooth germ; *AO*, area from which developing permanent canine tooth germ was removed.

A further comparison of the dentitions of human and cat was made microscopically. Fig. 17 is a photomicrograph of a human mandible aged 3 years, from Diamond,[8] showing the topography of a developing permanent central incisor germ in relation to the deciduous incisor. Note that resorption of the bony socket has begun. Fig. 18 is another photomicrograph of a human mandible aged 4½ years, also from Diamond, showing a later stage of development. The alveolus and the attachment apparatus of the deciduous root adjacent to the developing tooth germ have been resorbed, and the cementum and dentine are in an early stage of resorption.

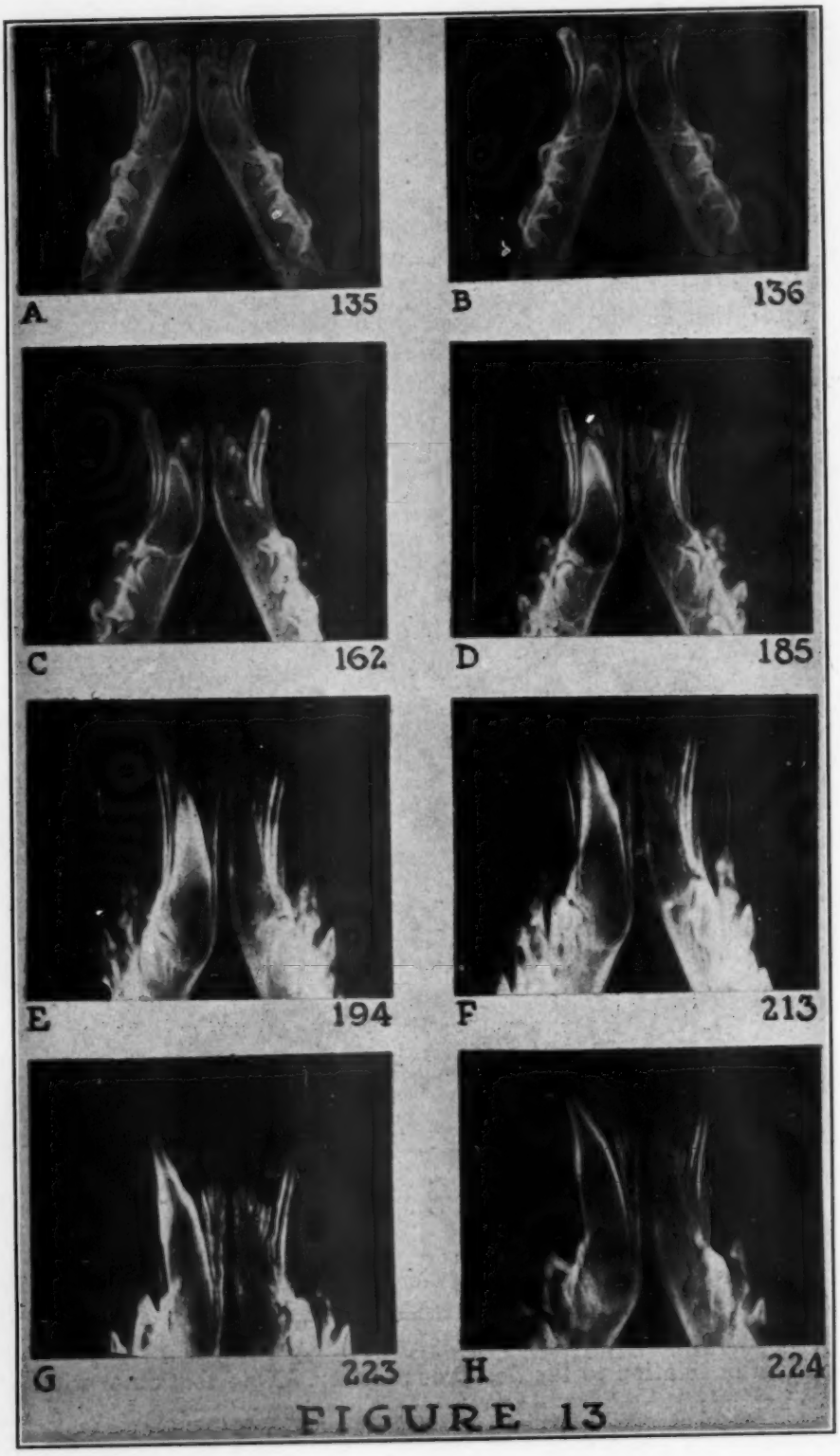


FIGURE 13

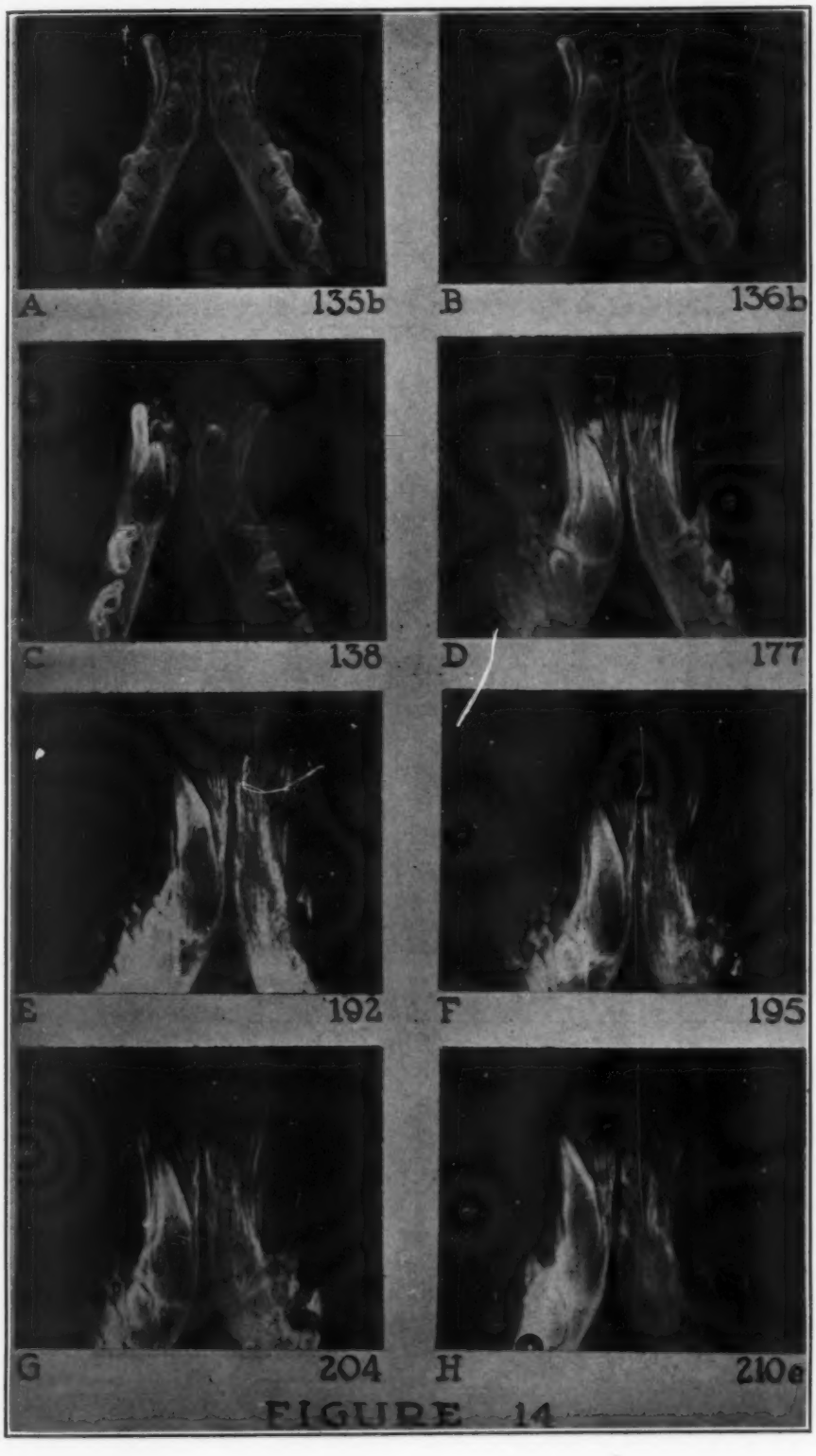


FIGURE 14

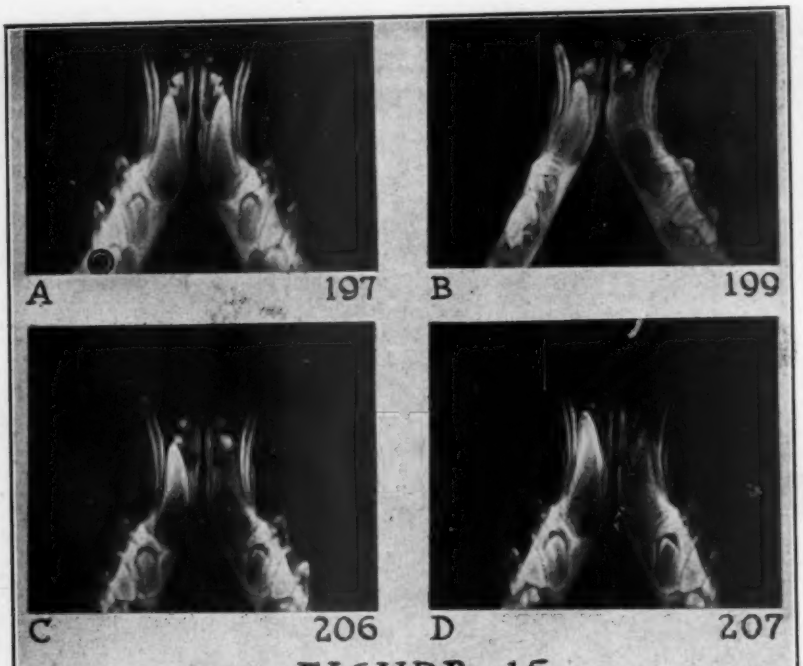


FIGURE 15

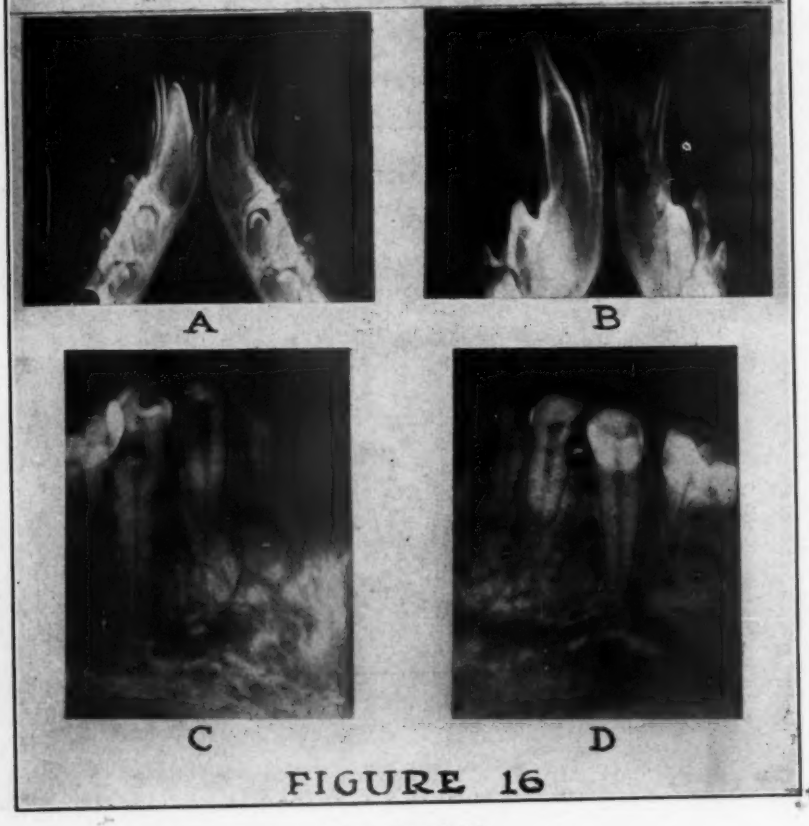
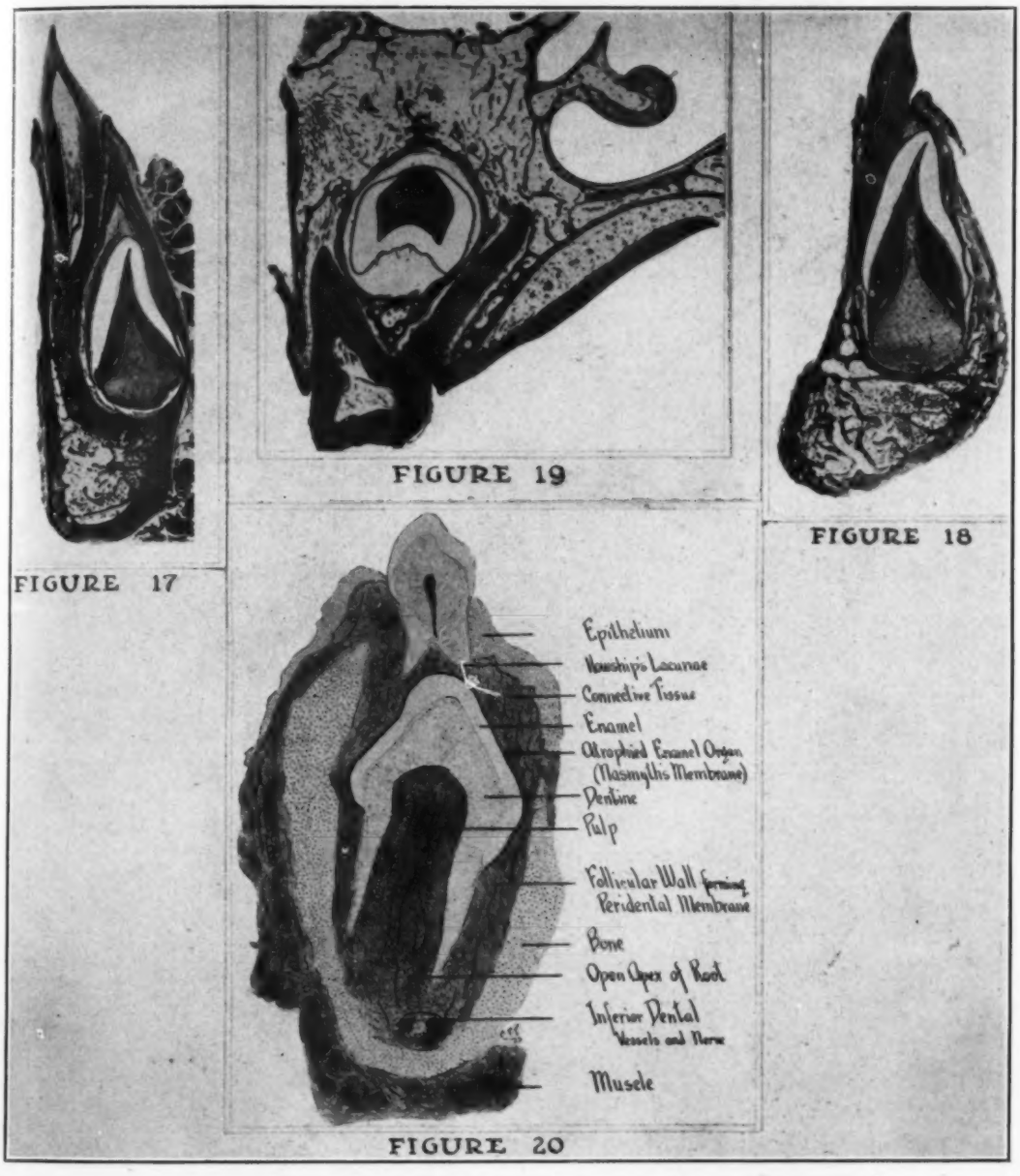


FIGURE 16

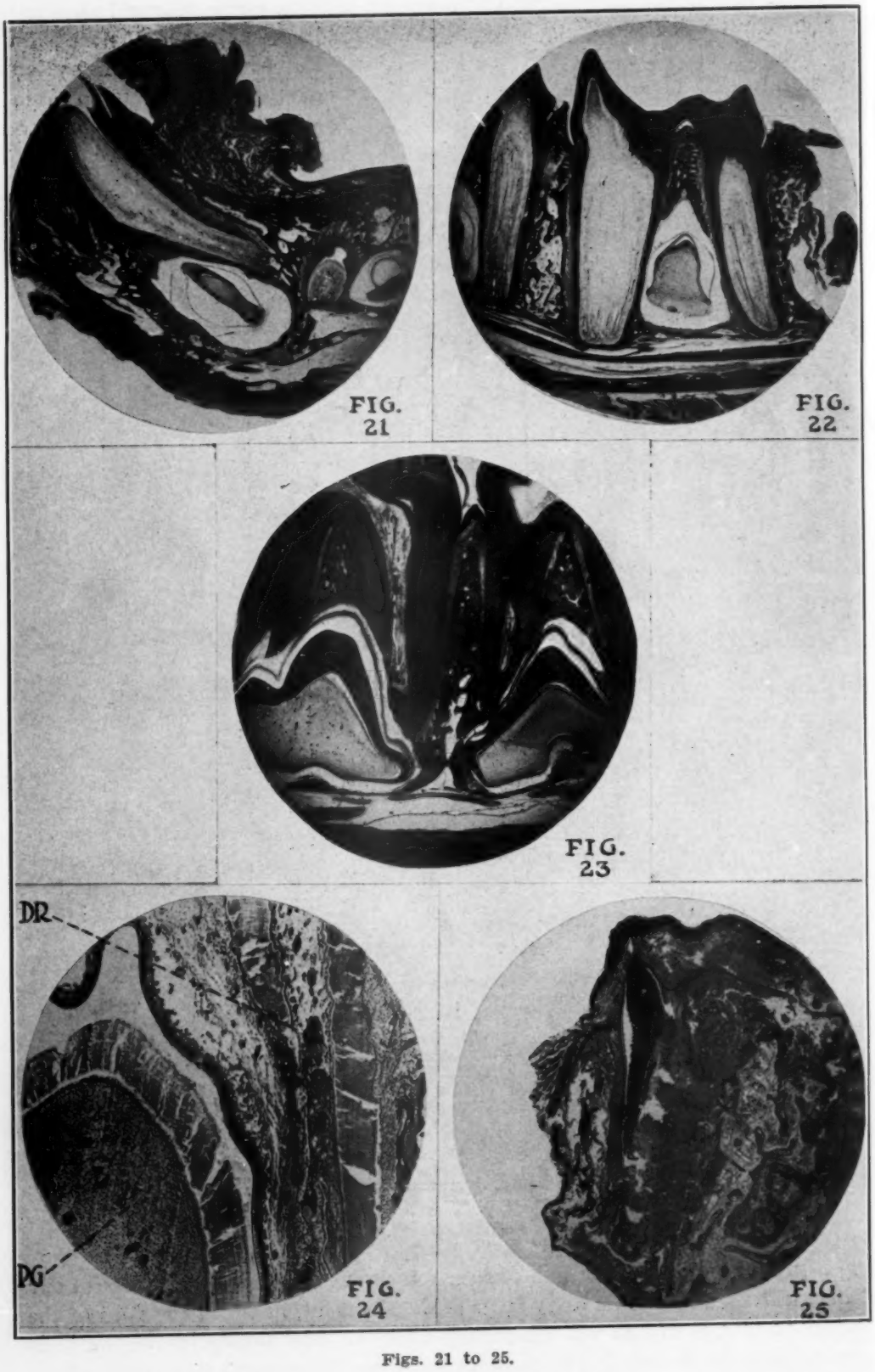
Figs. 15 and 16.

Fig. 19 is a photomicrograph of a human maxilla (from Meyer[9]) showing a premolar tooth developing between the roots of a deciduous molar. Note the position of the developing tooth germ and the beginning of resorption of the alveolar bone adjacent to the tooth germ. Fig. 20, a diagram from Boedecker,[10] presents a photomicrograph of the deciduous tooth of a cat showing similar resorption of the deciduous root.



Figs. 17 to 20.

Fig. 21 is a photomicrograph of a section through the mandible of one of our control kittens, showing an early stage of development, in which the apex of the deciduous root is not as yet completely formed. The resorption of the bone surrounding the developing permanent germ has progressed to a point where



Figs. 21 to 25.

the bony crypt which contains the developing germ lies adjacent to the deciduous root. No resorption of the attachment apparatus or the root occurs at this stage of development, nor does it occur until the deciduous root is completed.

Fig. 22 is a photomicrograph of a section through the mandible of one of our control kittens, showing a permanent premolar germ developing between the roots of the deciduous molar. On both sides the alveolar bone is resorbed. On one side the attachment apparatus and the cementum are resorbed, and the very earliest stage of resorption of the dentine can be observed as the outer epithelial layer of the crypt approaches the root of the deciduous tooth.

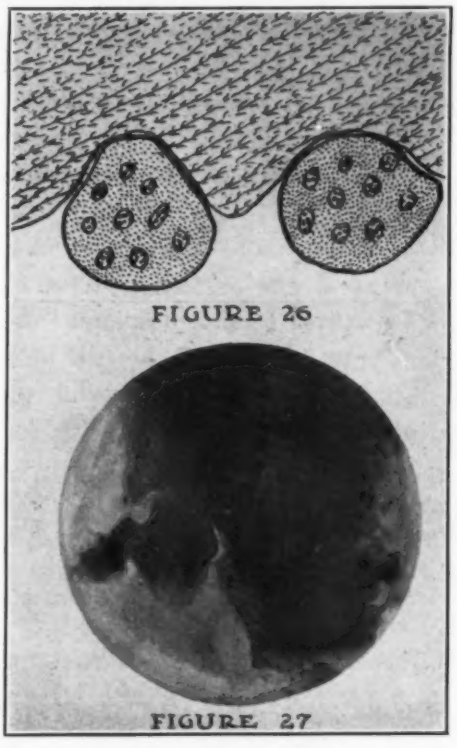


FIGURE 26

FIGURE 27

Figs. 26 and 27.

Fig. 23 is another photomicrograph of a section through the mandible of a cat, showing three progressively later stages in the resorption of deciduous roots and alveolar bone. The deciduous root on one side shows more resorption than that of the previous picture. The two roots of the adjacent deciduous molar show two later stages of resorption. Note how the contour of the area of resorption conforms in a general way to that of the adjacent crown of the developing tooth germ.

Fig. 24 is a photomicrograph on the unoperated side of one of our experimental animals. This is the most frequent picture of resorption we have observed. Deductively, this picture would tend to support the general conception that the presence of the developing permanent tooth is necessary for resorption of the deciduous root.

Fig. 25 is a photomicrograph of a section through the mandible on the operated side of one of our experimental animals, in which the developing tooth germ was removed, as described. The contour of the area of resorption is similar to that which occurs when the developing tooth is present, and the mechanism involved in resorption seems identical in both experimental and control animals as illustrated by the presence of odontoclasts lodged in Howship's lacunae. Fig. 26 is a diagram from Boedecker illustrating the position and structure of odontoclasts in the human, during resorption of the roots of teeth.

Fig. 27 is a photomicrograph under high magnification from one of our experimental animals, showing a single odontoclast lodged in a lacuna in the dentine. Several nuclei with their nucleoli may be seen.

SUMMARY AND CONCLUSIONS

1. The sequence and histologic picture of root resorption in the deciduous dentition are similar in the human and the cat.

2. Resorption of the root in the deciduous dentition of both the human and the cat is not dependent upon the presence of the developing permanent tooth germ for it has been shown to occur

(a) In congenital absence of the permanent tooth germ in the human, and

(b) In experimental removal of the permanent tooth germ in the cat.

3. These observations reveal the inadequacy of the long-held theory that resorption of the deciduous root is dependent upon pressure exerted by the developing permanent tooth germ.

We wish to make acknowledgment to Dr. Leuman M. Waugh of the Department of Orthodontia at the Columbia University Dental School for the radiographs of normally developing teeth in children.

For the radiographs showing congenital absence of permanent teeth in the human, we wish to make acknowledgment to Dr. Daniel E. Ziskin of the Department of Oral Diagnosis at the Columbia University Dental School.

We wish, also, to acknowledge the assistance rendered us by our technician, Mr. Sidney Shapiro.

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SOME PHYSICAL PROPERTIES OF THE LABIAL EXPANSION ARCH

DR. PETER ADLER, MAKÓ, HUNGARY

THE main objection to the labial expansion arch is that its expansive force decreases from the ends toward the center. It would be assumed as well that it has less biologic efficacy in comparison with other orthodontic appliances; however, the later statement has not yet been proved by objective facts.* Because of this decreasing expansive force, widening of the denture or jaw in the canine and first premolar region is difficult to perform, according to some authors. This objection was disproved by Körbitz[4] who compared each half of the expansion arch to a one-armed lever. He could prove that the elastic force of the arch increases from its ends toward the center, but its "working force"† remains constant. Although Körbitz' deductions relative to the elastic force of the arch are incontestable, they do not solve the principal problem, for not the entire elastic force of the arch is consumed in expansion. We must, therefore, first clarify the terms "expansion" and "expansive force."

Each half of the expansion arch can be compared to a one-armed lever which is rotated through a given angle. Each point of the arch has to pass a route corresponding to a segment of a circle if the fulcrum, i.e., the center of the arch, is not displaced. The position of each point of both halves of the arch is changed in two planes of the room; even if the arch lies horizontally the end points as well as every other point of both halves of the arch are displaced in both a transverse and a sagittal direction. Usually only the transverse displacement of the teeth is considered as expansion; the sagittal movement causes a definite diminution of the "altitude of the arch." By this latter component of the efficacy of the appliance, protruded front teeth can be retruded. This lingual shifting can be combined with expansion of the lateral parts of the dental arch. This combined movement was designated by Oppenheim[6] as "physical expansion" and considered as a particular advantage of the labial expansion arch compared with other expansive devices.

As only the transverse excursion of the arch is considered as expansion, only a part of the entire elastic force can be regarded as expansive force, i.e., that part which works in transverse direction. The relation of the elastic forces which work on different points of the arch does not determine the amount of the expansive forces. The latter can be calculated according to Fig. 1.

*Görbe and I proved that there is less strain on the molar anchor teeth when one uses a labial arch to rotate anterior teeth than if one uses a lingual arch to rotate them.[1] This mathematically deducted fact proves that the supposed biologic inferiority of the labial arch does not exist.

†The term "working force" (in the original German text: "Arbeitskraft") is unusual in German; it is not defined exactly. It seems to me that the author wanted to say "work" as used in physics.

The elastic force working on the end of the arch is marked P; the corresponding force working on any other point of the arch is marked P'. Momenta working on different points of the same half of the arch are equal, thus e.g., $P\,k = P'\,k'$ (whereby k and k' indicate the corresponding arms of the forces). In the transverse direction only a part of the force P is working; this force shall be marked P_t and can be expressed, according to Fig. 1, by the following equation (Fig. 1):

$$P_t = P \cos \rho, \text{ resp. } P_t = P\frac{a}{k}, \text{ or } P_t = P\frac{a}{\sqrt{a^2 + b^2}}$$

If P and a are constant and b is diminished, P_t increases. This fact is of importance in orthodontic practice: The narrower the dental arch that has to be expanded the larger will be the transverse component of a definite elastic force. This component increases from the end toward the center of the arch. In Fig. 1, this increase is shown on a half-ellipsoid arch. Its measure depends under

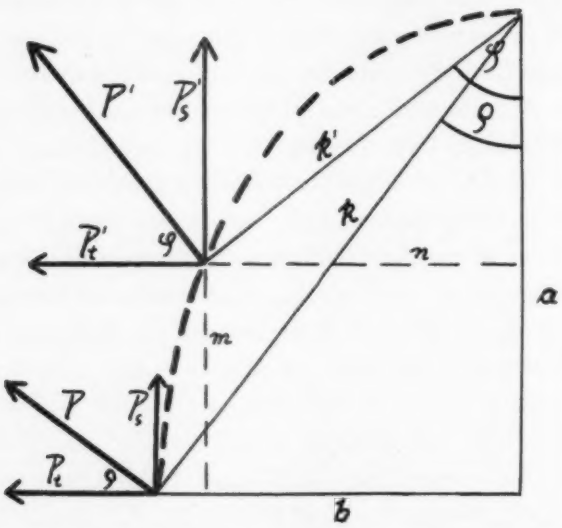

Fig. 1.—Distribution of the elastic forces working on different points of a half-ellipsoid arch in a transversal and sagittal component. Signs: a, altitude; b, half-breadth of the arch (longest resp. shortest half-diameter of the ellipsis); P resp. P', elastic forces working on different points of the arch; P_t resp. P'_t, transversal, P_s resp. P'_s, sagittal component of the elastic forces P resp. P'; k resp. k', arms of the elastic forces P resp. P'; ρ resp. ζ angles formed by the arm of the corresponding elastic force and altitude of the arch; m and n, coordinates of the point on which the force P' works. Coordinate-axes are a and b.

similar conditions on the linear eccentricity of the ellipse, but the exact determination of this relation is without any importance in practice. The relation of the transverse force working on any point of a half-ellipsoid arch to the transverse force working on its end is expressed by the following proportion (comp. Fig. 1):

$$\frac{P_t}{P'_t} = \frac{k' \cos \rho}{k \cos \zeta} \text{ resp. } \frac{P_t}{P'_t} = \frac{n^2 + (a - m)^2}{(a - m)(a^2 + b^2)}$$

The relation of the expansive forces is expressed by the same equation in otherwise shaped arches too, e.g., paraboloid, only the values of n and m are changed, corresponding to the changed shape of the arch. However, the expan-

sive (transverse) forces working on different points of a half-circular arch are equal (Fig. 2):

$$P_t = P\,\frac{r}{k}$$

$$P'_t = P'\,\frac{r-m}{k'};\; P' = P\,\frac{k}{k'}$$

$$\frac{P_t}{P'_t} = \frac{r\,k'^2}{(r-m)\,k^2}\;;\; \text{but } k^2 = 2\,r^2;\; k'^2 = n^2 + (r-m)^2;$$
$$\text{and } n^2 = r^2 - m^2;\; \text{thus}$$

$$\frac{P_t}{P'_t} = 1$$

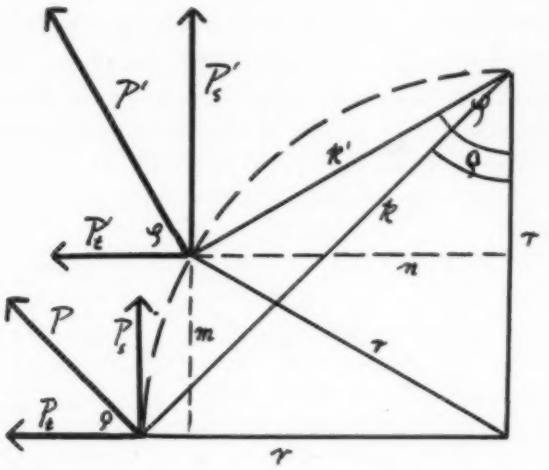

Fig. 2.—Distribution of the elastic forces working on different points of a half-circular arch in a transversal and sagittal component. Signs: Forces, arms and angles as in Fig. 1; Further r, radius of the circle.

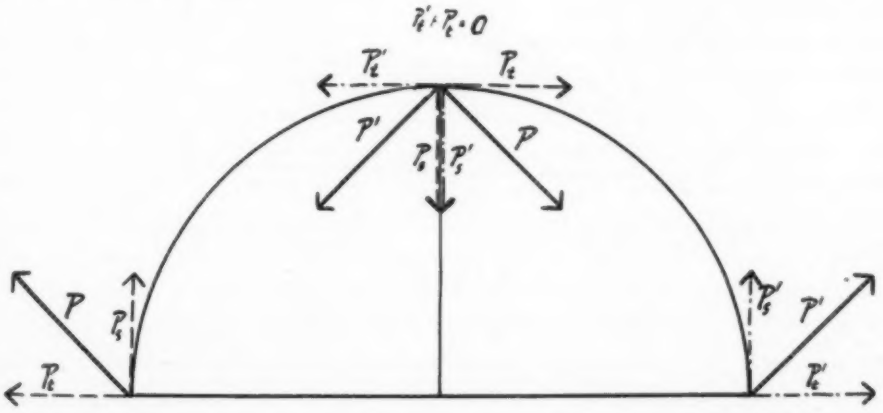

Fig. 3.—Reaction of the forces working on both ends of the arch on its center. Signs: P resp. P', elastic forces working on the ends; P_t, P'_t, P_s, P'_s, transversal resp. sagittal components of these forces. On the center of the arch equal forces are working, but in opposite directions.

If we assume that the force P (the elastic force of the arch) works on the end of the arch, its center is charged with an equal force acting in the opposite direction (Fig. 3). Assuming equal resistances against the movement of the teeth on both sides of the jaw, the center of the arch cannot be displaced laterally because both halves working in opposite directions support each other.

Therefore, the transverse component of the elastic force cannot act in the center of the arch but must work in all instances on its end or on any point of the lateral halves.

The sagittal component of the elastic force, on the other hand, can act in various ways: (1) It can act on the end or anywhere else on the lateral halves of the arch or (2) on its center. If it does not work in the center, both end points are displaced, as explained above, not only laterally (transverse component of the movement) but also forward (sagittal component of the excursion); the resultant of these two movements is obliquely mesiolateral. The potential effect of this component of the elastic force on the center of the arch is a displacement lingually; therefore, this component can be used for the lingual movement of protruded front teeth (physical expansion). If this lingual movement of the center of the arch takes place, the effect of the elastic force on the end points is changed: As the center is displaced lingually, the forward movement of the end points is diminished. The extreme possibility is that the center of the arch is displaced maximally toward the lingual, in which instance the

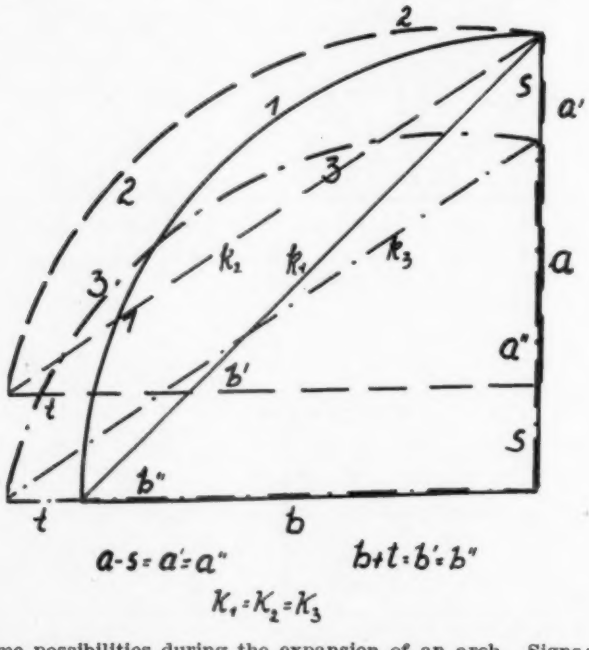

Fig. 4.—Extreme possibilities during the expansion of an arch. Signs: *1*, original passive state of the arch; *b*, its half-breadth; *a*, its altitude. *2*, the arch is rotated on its center whereby the center is not displaced; *b'*, corresponding (increased) half-breadth; *a'*, corresponding (diminished) altitude. *3*, the arch is rotated on its center but the center is displaced maximally towards oral; *b"*, corresponding (increased) half-breadth; *a"*, corresponding (diminished) altitude.

sagittal component of the elastic force was working only there; then the end points are displaced only buccally and will not undergo any displacement in a sagittal (mesial) direction. These different extreme possibilities are shown in Fig. 4. Line 1, Fig. 4, represents the original arch position; in one case (arch 2 in Fig. 4) the center of the arch maintained its original position, so at its end there occurred a shifting laterally and forward. In the other case (arch 3 in Fig. 4), the end point is displaced only laterally and the center lingually; thus each component of the elastic force was working at a different point of the arch.

The amount of the sagittal component of the elastic force depends, first, on the amount of the entire elastic force and secondly, on the shape of the arch. As the altitude of the arch, a, increases in relation to its half breadth, b, this component decreases. By means of Fig. 1, one can deduce the following formula expressing the sagittal component, P_s, of the elastic force on the end points of the arch:

$$P_s = P \frac{b}{\sqrt{a^2 + b^2}}$$

Where this sagittal component will actually become effective cannot be predetermined. The place of this effect is principally independent of our procedure as well as of the arch and its elastic force; it depends only on the resistance of the different groups of teeth to be moved, which is determined by the gross and minute structure of the alveolar bone. The ultimate effect of the sagittal component will differ in various mouths as the resistance of the anterior teeth against an eventual lingual movement relates to the resistance of the posterior teeth against an eventual forward movement combined with a buccal displacement, i.e., it is determined in all cases by the anatomic structure of the jaw. The occlusion has to be taken into consideration as well. Thus this sagittal component works according to the individually different static and mechanical properties of each denture. The term physical expansion may first of all express this property of the expansion labial arch. The reduction of the sagittal distance between anchor molars and front teeth, i.e., the diminution of the altitude of the arch, is in a definite relation to the expansion, but one cannot decide whether this decrease of the altitude of the arch is brought about by the lingual movement of the front teeth or the forward movement of the posterior teeth. The term physical expansion shall express as well the constancy of the relation between the diminution of the altitude of the arch and the transverse expansion.

For this purpose, the labial arch seems to be more advantageous than any device in which the expansion and the lingual movement of the front teeth (flattening) are performed without any definite relation to each other.

When a plate for expansion is combined with a labial wire in the anterior region for flattening, both movements take place simultaneously, but even this method is inferior to the labial expansion arch. To begin with, one must consider that the shape of the labial wire is altered by the expansion of the plate in a very different manner than the labial arch is, when bent in its central portion. This difference is shown in Fig. 5. A further fact of great importance is that the labial wire becomes flattened by the expansion of the plate and tends, in consequence of its elastic properties, to assume its original shape. On the other hand, the expansion arch is at first shaped for its intended action; if now inserted into the molar sheaths, it becomes active. As soon as the teeth give way and expansion takes place, the activated labial arch becomes passive again. In the front region of the expanding plate we find two forces at work: (1) the expansive force of the plate (Coffin spring or screw) and (2) the resistance of the labial wire against any deformation; this resistance works in the opposite direction to the expansive force of the plate. Therefore, each half of the plate must be rotated on a fulcrum, situated between the attachment of the labial

wire and the position of the screw or spring, if we assume that the spring can be bent or that the screw gets loose. In consequence of this mechanical condition, the expansive effect of the plate is generally smaller anteriorly than in the distal parts. The resistance of the labial wire can be eliminated by reshaping as the expansion proceeds. It must be admitted, however, that thereby the definite relation between the transverse and sagittal force is altered.

Relative to the expansion of the jaw by plates, I want to mention here that with the use of simple screws (Nord,[5] Biró[2]) the distal part of the dental arch is more expanded than its frontal region, even if no labial wire is used. The probable cause for this is the difference in the resistance of the front teeth as compared with the posterior teeth against a lateral movement. The molars and premolars are displaced buccally where they find a relatively small resistance. In consequence of the curved shape of the dental arch, the front teeth during expansion have to be displaced practically toward their neighbors, which means in the direction of a greater resistance. According to these different resistances, simple screws, especially those of nonprecious metal, are worn out by friction. In the use of stiffened screws (suggested by Tischler or Karp, described in detail by Hausser[3] resp. Schwarz[7]) the front and distal parts of the dental arch can be equally expanded because these screws are sufficiently resistant against wear. In the use of plates for the combined expansion and flattening, this circumstance has also to be taken into consideration.

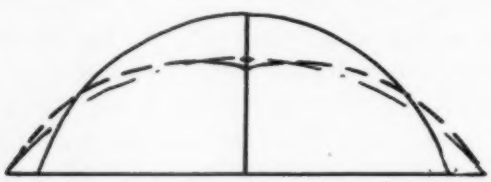

Fig. 5.—Change of the shape of the arch according to the manner of expansion (Wipla-wire 0.7 mm. diameter). Signs: full line, original passive state of the arch; the —·—·—·—, wire is stretched by pull on its ends; – – – –, each branch of the arch is rotated on the center as fulcrum.

The simultaneous expansion and eventual flattening of the front (but implicit diminution of the altitude of the arch) happens only in the use of the labial arch corresponding to the physical state of the denture and of the jaw, and is without any doubt an advantage not to be underestimated.

The diminution of the altitude of the arch, s, is in a definite relation to the transverse excursion t. This relation can be expressed by the following equation (Fig. 4):

$$a^2 + b^2 = (b + t)^2 + (a - s)^2, \text{ or written in another form}$$
$$t^2 + 2\,b\,t + s^2 - 2\,a\,s = 0$$

The relation of the angle of deviation of each branch of the arch, α, to the transverse, t, and to the sagittal excursion, s, of the end point can be determined according to the following equations (Fig. 6):

$$\overline{E_1E_2} : k = \sin \alpha : \sin (90 - \alpha/2)$$

$$\overline{E_1E_2} = \frac{t}{\cos \epsilon}$$

$$\overline{E_1E_2} = \frac{s}{\sin \epsilon};$$

thus if α is known, follows:

$$t = \sin \alpha \ (a - b \operatorname{tg} \alpha/2) \text{ and}$$
$$s = \sin \alpha \ (b + a \operatorname{tg} \alpha/2).$$

This value of s expresses the total diminution of the altitude of the arch, independently of whether its ends are displaced mesially or whether its center is displaced lingually. If t or s is known, we can calculate α:

$$\sin \alpha/2 = \pm \sqrt{\frac{a^2 - bt \pm \sqrt{a^4 - a^2 t^2 - 2 a^2 b t}}{2 (a^2 + b^2)}}$$

$$\sin \alpha/2 = \pm \sqrt{\frac{b^2 + as \pm \sqrt{b^4 - b^2 s^2 + 2 b^2 as}}{2 (a^2 + b^2)}}$$

The mathematical deduction of these results from the three equations according to Fig. 6 is very simple; therefore, it is omitted.

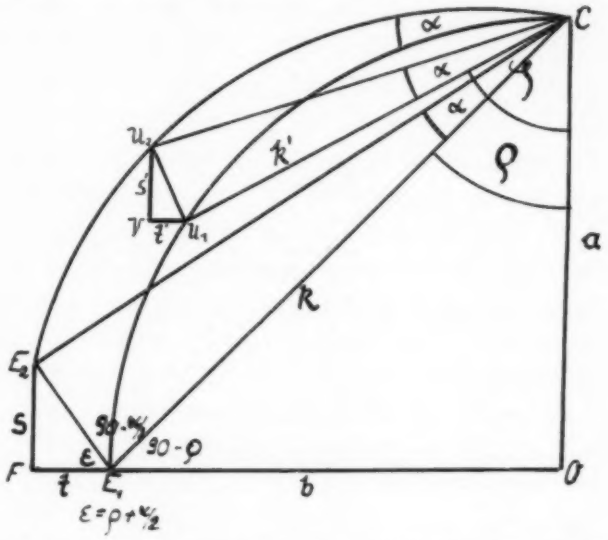

Fig. 6.—Calculation of the transversal resp. sagittal excursion of any point of an expanding arch. Signs: *O*, center of the geometric figure; *C*, center of the arch, fulcrum of the rotatory movement of each branch; α, angular deviation of each branch; $\overline{E_1E_2}$, chord of the circle which is covered by the end point; $\overline{U_1U_2}$, chord of the circle which is covered by any other point; ϵ, angle lying at E_1, formed by the chord $\overline{E_1E_2}$ and t; t and s, resp. t' and s', transversal resp. sagittal excursions of the two points. Other signs as in Fig. 1.

One can calculate too the expansive work of the arch. We find that the work (result) of the arch during expansion is different at different points. The expansive work of the arch is logically the product of the expansive (transverse) component of the elastic force and of the transverse excursion (way). The transverse excursion of any point can be calculated in a very simple way; e.g., the transverse excursion of the end point is (Fig. 6):

$$t = 2k \sin \alpha/2 \cos (\rho + \alpha/2)$$

resp. of any point in the course of the arch:

$$t' = 2k' \sin \alpha/2 \cos (\zeta + \alpha/2).$$

By multiplying the transverse excursion (way) with the transverse force we get as result the transverse work. However, we must not forget that the trans-

verse forces at different points (and which were calculated in the foregoing) decrease in the course of the movement; therefore, the calculation of the expansive work is only an approximate one.

The relation of the transverse work of the two different points of the arch (W_t and W'_t) can be expressed by the following equation:

$$\frac{W_t}{W'_t} = \frac{\cos \rho \quad \cos (\rho + \alpha/2)}{\cos \zeta \quad \cos (\zeta + \alpha/2)} \text{ (approximately).}$$

Considering that $\rho < \zeta$, further that $\rho < 45°$, $\zeta < 90°$, and that $\alpha/2$ generally is a very small angle, therefore we have to take for granted that $(\zeta + \alpha/2) < 90°$, and $W_t > W'_t$. This mathematical deduction shows that the expansive work of the arch increases from the center toward its ends. The greatest work is performed at the end. This property demands the use of different auxiliary mechanisms for the expansion in the region of the canines and first premolars. The best means seems to me to use sheaths with oval cross section on the anchor bands. This apparatus is proposed and described in detail by Oppenheim.[6] By the use of this device (schematic drawing is shown in Fig. 7) the transverse component of the elastic force works on the end of the arch only over a short distance. The transverse force engaging the canine and first premolar works over the same distance as it does with the use of the standard device (round molar sheaths). By using such oval molar sheaths, we can change in any manner or equalize the difference in the transverse (expanding) work of the elastic force acting on different points of the arch. Even in cases where an expansion of the jaw is desired only in the canine-premolar region, the use of such molar sheaths is more advantageous than the use of anchor bands on the first premolars, because eventual vertical displacements of the arch are successfully prevented by the stationary anchorage of the molars.

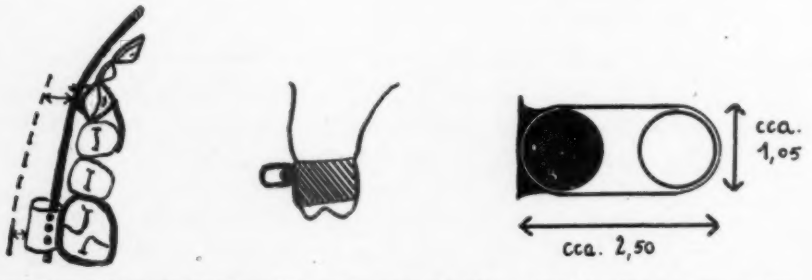

Fig. 7.—Sketches of the appliance with cross oval sheaths. The sheaths are in reality not oval, but parallelepipeds supplemented by two half-circles.

All these calculations are valid only for a labial arch that is provided with spurs at the anterior end of the molar sheaths so that the arch in its passive state touches the front teeth. The spurs prevent the arch from sliding distally into the sheaths. As well the sliding out off the molar tubes shall be prevented, in the simplest way by means of ligatures. Thus the real longitude of the arch is defined. If the spurs are omitted, or do not lie exactly at the anterior end of the sheaths, the arch can slide deeper into the molar tubes. The definite relation of the forces is thus changed, and one cannot foretell what will happen—

whether the molars will become expanded or whether the arch will slide deeper into the sheaths, displacing thereby the front teeth lingually.

In consideration of the indefinite conditions in the use of arches without spurs, one cannot determine exactly the forces which are acting on the different points of the arch. One cannot decide beforehand where such arches will be acting. Therefore, for expansion, use of arches with spurs in front of the molar sheaths seems to be more advantageous.

SUMMARY

Only a part of the elastic force of an expanding arch is consumed in the transverse expansion of the dental arch or jaw. Its amount depends ceteris paribus on the shape of the arch. The expansive work of the arch increases from the center toward its ends. Therefore, for the expansion in the canine-premolar region the use of oval molar sheaths is recommended (Oppenheim). The lingual movement of protruded front teeth occurs simultaneously with the expansion of the lateral parts of the dental arch and corresponds to the statical and mechanical properties of the denture and jaw (physical expansion). The relation of the transverse expansion to the decrease of the altitude of the arch is constant.

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TREATMENT OF CLASS I ANOMALIES

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THE definition of Class I (according to the Angle classification) is, "Mandibular arch of teeth in normal mesiodistal relation with the maxillary arch of teeth." The original key to occlusion is the relation of the mesiobuccal cusp of the maxillary first molar to the buccal groove of the mandibular first molar. I dare say the majority of us still regard this relation in our initial diagnosis of our cases. The basis for classification is, therefore, quite evidently upon the relation of the arches of teeth rather than upon the relation of the mandible to the maxilla, dependent as it is, upon the articulation of the condyloid process of the mandible with the articular disc of the temporal bone.

Of equal importance in understanding treatment is the physiologic response of the different types of bone of the maxilla and mandible to variable pressures. Histology shows the bones of the face and jaw to be membrane bones developed directly from connective tissue without having been preformed in cartilage. As the membrane bones enlarge, the central portion through resorption becomes loose spongy bone which is encased on all sides by an outer or cortical layer of compact bone. The mandible is developed around a pair of cartilages (known as Meckel's cartilages). The form of a membrane bone is determined by the development of a periosteal membrane from the mesenchyma. The size and shape of the bony architecture of the face are therefore quite largely a predetermined inherent growth possibility of the individual. Changes in design of the denture are influenced to a great extent by extrinsic tendencies because of the spongy supporting bone in which the alveoli of the teeth are imbedded (Fig. 1).

Gentle pressure applied to the teeth exerts force through the periodontal fibers which afford the attachment of the cementum of the root of the tooth, to the alveolar bone or tooth socket. Pressure is thereby transmitted to the supporting bone. The periodontal membrane, therefore, suspends the teeth in their alveoli. Only the inner layer of bone surrounding the root may be considered alveolar bone; the other bone adjacent to the alveolus is the bone of the jaw or supporting bone. It is by virtue of the modification of this spongy or supporting bone that the orthodontist can remold the architecture of the maxilla and mandible. Of importance then is the length of roots to afford stimulating pressure as deeply as possible and the vertical dimension of the jaw. It is quite obvious that growth of this area beyond the apical ends of the roots must be controlled quite largely by the inherent ability of the individual to develop the supporting structures into a strong facial contour rather than the efforts or ability of the orthodontist. A child inheriting a tendency toward a receding or an underdeveloped mental eminence, no matter how far the teeth may be mechanically protruded, will continue to exhibit a weakness of the lower one-third of the face unless natural inherent growth processes occur. We must recognize our limitations.

Read before the American Association of Orthodontists, April, 1939, Kansas City, Mo.

In the belief that the biologic phases of growth treatment have in the last few years been quite well covered in our programs; and reminded that my last three published papers on treatment have dealt with the so-called biologic aspects rather than with mechanical technique of treatment, I shall devote this paper to mechanotherapy. It has been said, "No one would choose a surgeon for his mechanical dexterity if he had no knowledge of the basic sciences of medicine." Conversely, theoretical knowledge without technical ability will not suffice.

For many years I have felt that the teaching of classification using Angle's Class I, II, and III has been unsatisfactory. It does not correlate etiology and classification with treatment. It does not convey a picture to the student's mind which can be retained long after graduation. Many have attempted to reclassify malocclusion, only to find their results based upon the original classification. This no doubt speaks well for Dr. Angle's original effort.

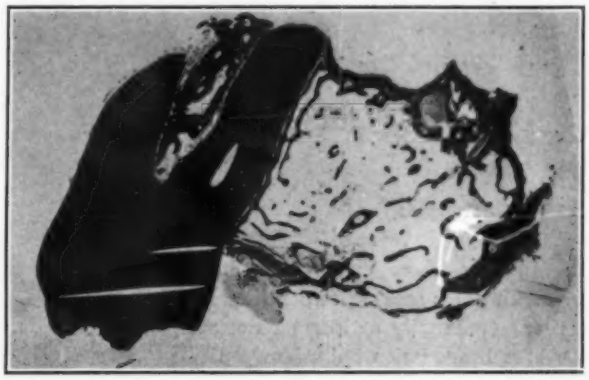


Fig. 1.

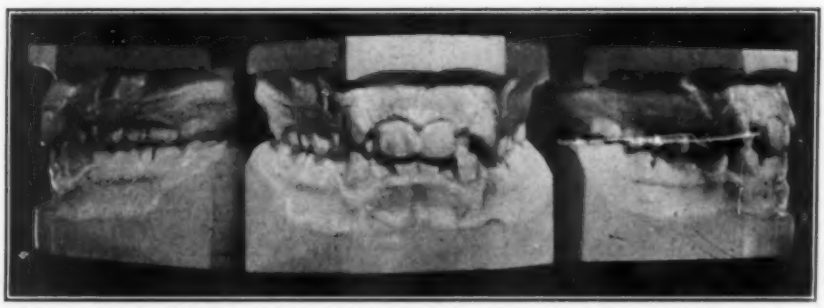


Fig. 2.

Dr. Dewey simplified Class I somewhat when he divided the class into three types, giving each type a description which can be associated with treatment. Dr. Lischer gave the classification a better terminology when he described Class I as neutroclusion; Class II as distoclusion; and Class III as mesioclusion and only recently proposed the terms eugnathic and disgnathic, eugnathic referring to those anomalies of the teeth not involving facial malformations, disgnathic those anomalies which do involve facial disfigurements or complications.

Firmly convinced that the understanding of treatment can be simplified by grouping similar types and subtypes according to etiology and treatment, I have formulated an outline which is a superficial digest of only the more significant points of the classification of Class I. Etiologic factors, appliance design, and

treatment are here correlated, but variation and elaboration may always be anticipated. It is hoped this presentation may stimulate others to complete it in a satisfactory way.

CLASSIFICATION OF MALOCCLUSION

CLASS I—NEUTROCLUSION

Definition: Arches of teeth in normal mesiodistal relation.

Type 1.—Bunched maxillary and mandibular anterior teeth; lack of growth in anterior segment.

Etiology:

a. Too early loss of deciduous teeth, lack of anterior development.
b. Abnormal muscular habits.
c. Missing teeth, impactions.
d. Malnutrition.
e. Malfunction.

Treatment: Produce lateral growth and some forward growth by using one or more of the following types of appliances.

a. A modified parallel tube appliance for bodily tooth movement.
b. Lingual appliance for gentle, simple tooth movement.
c. Labial aligning appliance for general alignment of teeth where stability of anchorage is required.

Type 2.—Protruding maxillary anterior teeth associated with retruding mandibular anterior teeth.

Etiology: *Maxillary arch.*

a. Protruding maxillary anterior teeth associated with habits of thumb- or finger-sucking, lip-sucking and biting.
b. Sometimes (primarily at least) associated with adenoids.
c. Mouth breathing, lack of lip function.
d. Abnormal muscle pressure.
e. Inherited tendencies.

Mandibular arch.

a. Similar in etiology and corresponding to Type 1.
b. Too early loss of anterior deciduous teeth.
c. Lack of anterior lateral growth.
d. Missing or impacted premolars, mutilations.
e. Underdevelopment of mental eminence.

Treatment: *Maxillary arch.*—Expand maxillary arch and retract anterior teeth by using one or more of the following types of appliances:

a. Labial retraction arch.
b. Lingual appliance for widening in premolar region.

Mandibular arch.—Similar in treatment to Class I Type 1. Develop mandibular arch laterally in anterior region and slightly forward by using one or more of the following appliances:

a. A modified parallel tube appliance for bodily movement.
b. Lingual appliance for gentle, simple tooth movement.
c. Labial aligning appliance for general alignment of teeth where stability of anchorage is required.

Subtypes.—The following are characteristic types of irregularities found in Type 2:

1. Spaced and protruded maxillary teeth, fairly regular alignment of the mandibulars.
2. Irregular protruding maxillary teeth, mandibular anterior teeth crowded.
3. Crowded or slightly protruded maxillary teeth, mandibular anteriors fairly regular or crowded with lack of anteroposterior development as a result of a too early loss of the mandibular deciduous molars, impacted or missing premolars.

Treatment of subtype 3:

Maxillary arch.—Labial alignment appliance for expansion and correction of individual tooth position. Retract if protrusion is apparent.

Mandibular arch.—Move mandibular anterior teeth forward by means of jack-screw intermittent force or continuous spring tension molar to canine. Correct irregularities of individual teeth with labial alignment appliance. Use bite plane for open bite.

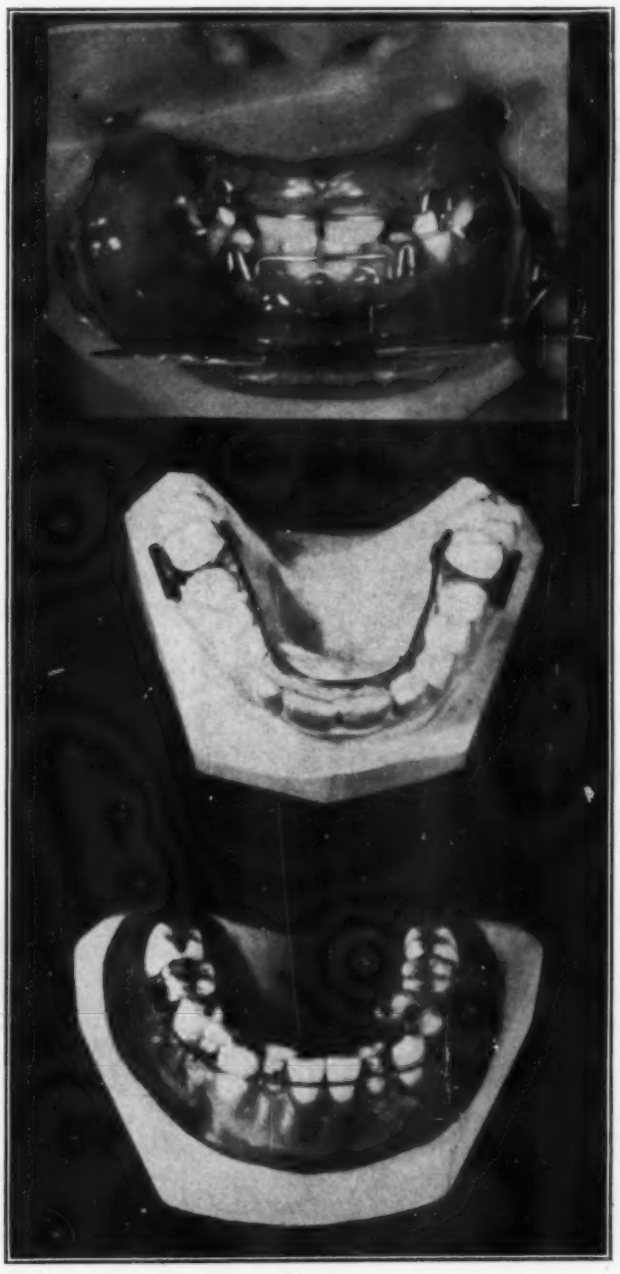


Fig. 3.

Type 3.—Retruding maxillary anterior teeth associated with protruding mandibular anterior teeth.

Etiology: *Maxillary arch* similar to Type 1.

a. Too early loss of deciduous anterior teeth. Lack of growth in anterior segment. Bunched anteriors, canines in labioversion.

b. Missing lateral incisors.

c. Too long retention of maxillary deciduous central or lateral incisors. Lingual eruption of permanent anteriors.

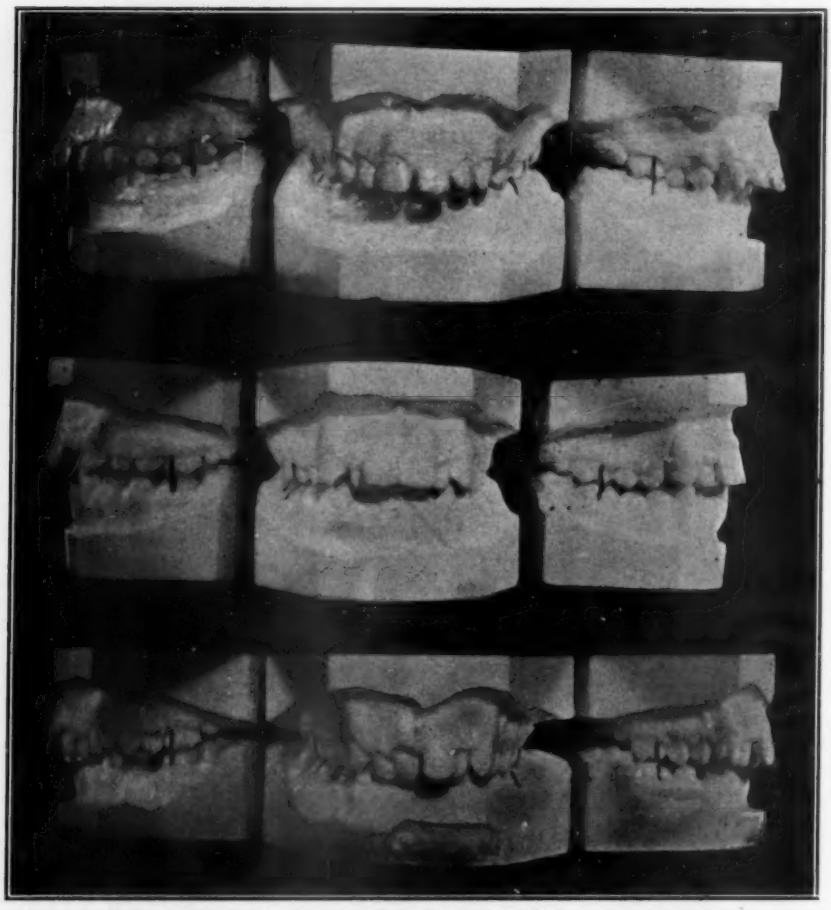
Mandibular arch.

a. Mandibular arch in fair alignment. May have spaced and protruded anterior teeth. Abnormal tongue pressure often associated with enlarged tonsils. Improper inclined plane locking of incisors.

Treatment: *Maxillary arch.*

a. Expand arch and carry maxillary anteriors forward, jump bite of anterior teeth, open bite temporarily, if necessary, by blocking up molars.

b. Bridge in missing lateral incisors or close space by drifting posterior teeth forward.



A.

B.

C.

Fig. 4.

Mandibular arch.

a. Modified parallel tube appliance as in Type 1.

b. Labial alignment appliance.

c. Lingual appliance.

Subtypes.—The following are characteristic types of irregularities found in Type 3:

1. Spaced and protruded mandibular teeth, fairly regular alignment of the maxillary ones.
2. Regular or spaced protruding mandibular teeth, maxillary anterior crowded.

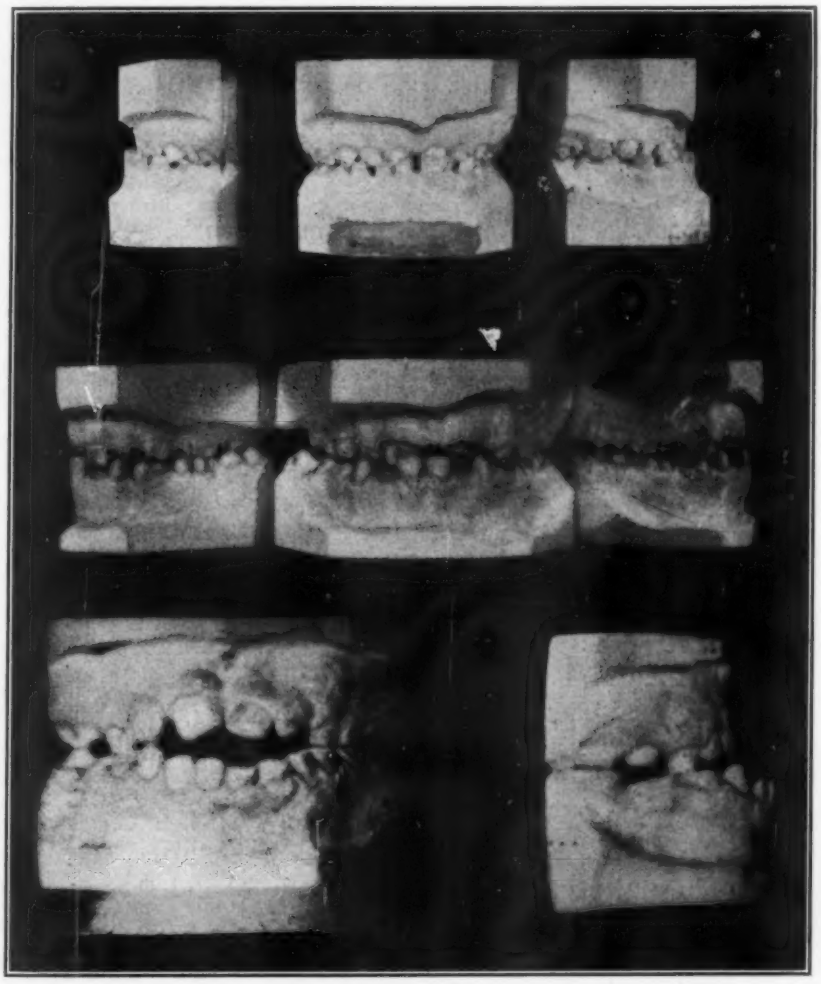
3. Crowded or slightly protruded mandibular teeth, maxillary anteriors fairly regular or crowded, with lack of anteroposterior development as a result of a too early loss of the deciduous molars, impacted or missing maxillary premolars.

Treatment: *Maxillary arch.*

Move maxillary anterior teeth forward by means of jackscrew intermittent force or continuous spring tension molar to canine. Correct irregularities of individual teeth with labial alignment appliance. Jump bite of anterior teeth, open bite temporarily if necessary by blocking up molars.

Mandibular arch.

Labial alignment appliance for correction of individual tooth position. Retract if protrusion is apparent.



A.

B.

C.

Fig. 5

Summarizing the classification you will note that the same etiologic factors and treatment that prevail in Class I Type 1 exist also in Type 2 mandibular arch, and Type 3 maxillary arch. And the same conditions which are found in the maxillary arch of Type 2 are also found and similarly treated in the mandibular arch of Type 3; needless to say, modifications to meet individual condi-

tions in appliance design are always necessary, but the study of type irregularities and the correlation of fundamental appliances are a definite aid to the young orthodontist who may at times be confused as to the correct type of appliance to use.

Orthodontics, however, will never be regarded as an exact science because of the individuality of cases; but if we regard our initial procedures as efforts to stimulate cell growth in the remolding or formation of the supporting bone of the maxilla and mandible rather than an immediate correction of individual tooth positions, we may use rather standardized foundation appliances to accomplish given procedures. If we plan our treatment so as to *aid* natural growth rather than to *force* it, one may find it necessary to apply stimulating pressures at different periods according to the growth order of the denture. These initial programs of development many times are for the sole purpose of modifying the architecture of the supporting bone, little effort being made to correct individual tooth positions. When we consider that the alveolar bone atrophies as the deciduous root absorbs and the roots of the permanent teeth are encased in a newly formed alveolar bone socket, it becomes quite apparent that correction of irregularities of the deciduous denture has little effect upon the permanent dentition, except as the pressure applied in an expansion program creates a broader design of the supporting bone.

As we grow older in practice, certain principles become more and more apparent. The conviction I have is that our supervision is not one of a year or so to the end that we correct certain obvious irregularities and then dismiss our patient as finished, but a contract to direct the growth phases of the dentures from the deciduous set through the transition period and until the completion of the permanent dentition. The use of appliances should be restricted to periods when natural growth is manifest in certain areas in an effort to "catch up" arrested developments. For the most part our treatments are of a mechanical nature. If the retardation in growth has been caused by environmental or exherent causes, mechanical treatment will suffice; however, if the anomaly is a result of inherent factors which have inhibited the growth, mechanical means may stimulate the immediate development necessary, but we have no assurance that these same internal inhibitions will not again arrest growth processes. Failure to properly supervise a case after a period of successful treatment often results in recurrence of irregularities.

There are many factors which are commonly spoken of as contributing causes in the relapse of a correction. One which I think contributes to many a secondary crowding of mandibular anterior teeth around the age of 10 to 12 years is the eruption of the mandibular canines. I have not observed much in the literature concerning this factor. The eruptive force of the canines is sufficient to move the teeth of the entire arch. Quite often the canines in their eruption have a definite mesiolingual inclination. This results not only in crowding and rotation of the four incisor teeth, but also in torsoversion of the canines. It is a fact also that disorderly eruption of the canines and premolars often restricts the natural space for the canines. Normally if the eruption of the premolars precedes that of the canines, ample space is provided for the canine because of the greater anteroposterior dimension of the two deciduous

molars as compared to the same measurement of the premolars. If, however, the canines erupt before the deciduous molars are shed, insufficient space will be provided for the canines, and they will either erupt in a torsi position or force the anterior teeth into a crowded alignment. Supervision and oftentimes extraction of deciduous molars at this time is necessary.

The lack of vertical development associated with a deep anterior overbite is a complication which we find many times in Class I Type 2. In reviewing the growth and tooth eruption of the deciduous and permanent dentures we find considerable anterior overbite present until the completion of the permanent dentition (except for the third molars) at the age of 13 to 14 years. This is a natural consequence considering the contact of the gum pads prior to the eruption of the deciduous anterior teeth and again the length of the permanent anteriors as compared to the shorter deciduous teeth. Two important periods in reducing overbite are: first, the time of the eruption of the premolars, and second, during the

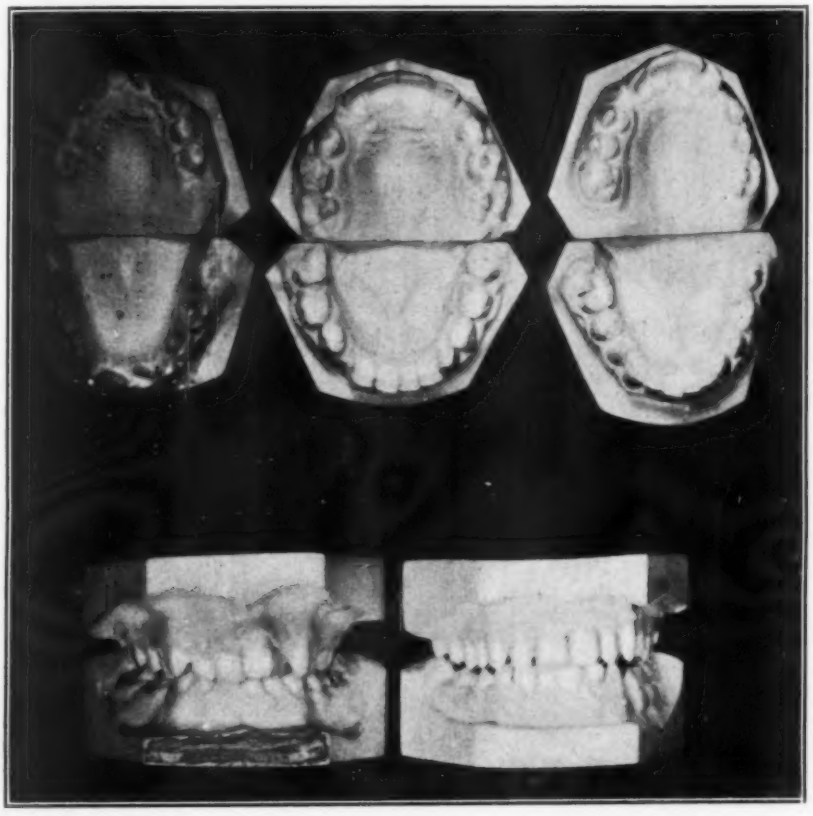


Fig. 6.

eruption of the second permanent molars. Complete growth and occlusal contact of the premolars not only is a factor in establishing anteroposterior relations, but also is a definite factor in opening the bite. The second molars occupy a posterior position where the slightest over eruption creates considerable opening in the anterior segment. They assume their position in the line of occlusion at the age of adolescence when the features change from childhood conformations, to the more mature angularities of young adulthood. Treatment including the

bite plane, intermaxillary anchorage for over erupting the molars, and mounting incline plane relations are helpful at this time. Many cases, however, through natural tendencies or during correction of irregularities of alignment, will inadvertently improve in respect to deep overbites (Fig. 6). Lack of vertical growth of the mandible influenced by inherent or inherited tendencies is difficult to treat, and a complete correction cannot always be anticipated.

Experience leads me to make one other observation: the necessity of x-raying the third molars at about the age of sixteen. Too many cases are dismissed at the age of 13 or 14 without knowledge of the position of the third molars. As a result many irregularities are forced in the mandibular anterior teeth (occasionally in the maxillary) because of the forward inclination of the third molars. A checkup at this age bespeaks a friendly interest and many times prevents a beautiful result being spoiled because of a few minutes of neglect. Extraction of these impactions before damage is done is a rational procedure.

I would like to quote from a paper I read before this society in Toronto, 1933, on "What May Be Considered Rational Methods of Orthodontic Therapy?" I consider it a basic principle of treatment.

The application of mechanical procedure may be divided into three periods; "First, that early period of childhood where the slightest stimulating pressure is capable of modifying arch form (from 4 to 8 years in the average child). Age, however, is sometimes misleading in considering development.

"Second, the intermediate period when natural growth must be augmented by greater stimulating pressure, plus a certain amount of definite force. (Age 8 to 12 years.)

"Third, the period following the eruption of the permanent dentition, age from 12 on, when definite force must be applied to malposed teeth to move them into correct positions."

The first period obviously requires considerable skill and knowledge in knowing when to begin treatment and to what extent mechanical influences will be most favorable. It is the period of considerable natural growth. Mechanistic force should be applied only in very small amounts and with discretion, so that natural impulses will be favored and not obstructed. There may be little actual treatment needed at this time; what is required may be only the elimination of occlusal disharmony in one or two teeth or the elimination of some slight point of interference. When appliances are necessary, anchorage to the second deciduous molars is always desirable. The length and spread of the roots afford a better stimulation for the modification of the supporting bone than that of the partially formed roots of the first permanent molar. Development is necessary more often in the premolar region than in the first molar position. Lingual appliances for gentle application of pressure are often all that is required; however, where bodily tooth movement is indicated, a modified parallel tube appliance is recommended. The appliance may be removed at intervals; and natural growth observations as well as the establishment of occlusion through natural eruptive processes may be watched.

The second period is one more closely involved with the transitional period, the exfoliation of the deciduous teeth and the eruption of the permanent teeth. Here, mechanical force is often required, but the natural forces of growth of the

entire arch are still favorable. Individual tooth positions require adjustment. If there has been neglect over the earlier years, extreme malocclusion may have developed requiring exceptional skill and the utilization of highly organized appliances for correction. It is in this group, 8 to 12 years, that we are most often called on for treatment. Attention is directed to two phases, first, natural growth of the entire arch brought about by inherent factors; second, changes of individual tooth position through the application of definite force.

This may be accomplished for the most part by the lingual appliance; however, it has been my experience that most cases can be aligned more perfectly and can be finished with greater ease by using a labial alignment appliance than by attempting the completion of the case solely with a lingual appliance. I therefore solder buccal tubes as a part of every lingual appliance.

The third period is the one most influenced by appliances for correction. True, there is growth at this age, but not to the extent of the previous periods. The teeth with the exception of the third molars have erupted, and the malocclusion is established. This is the time which previously was thought to be best for correction, but the study of growth processes convinces one that corrections are most easily accomplished at the age in which growth occurs—usually prior to 13 years. Treatment in this period depends upon one's ability to move teeth definitely from one position to another. Application of force and anchorage must therefore be more positive and of greater intensity. Lingual appliances are used in my practice quite effectively in the early stages of correction, and occasionally throughout the treatment, but I feel that the most definite application of force during this period is through the correct use of the labial alignment appliance. We have many types of these, and I would not for one moment discredit any one. They all have merit. It becomes a personal equation as to which appliance you learn to use and manipulate with proficiency.

There are many modifications which become apparent as the operator becomes familiar with the possibilities of the appliance. Time will not permit further discussion. The treatment of Class I anomalies is no different from the standpoint of development of the individual arch of teeth and supporting structures than any other class. The fundamental principles of treatment are the same.

Orthodontic therapy, therefore, represents the culmination of all our theoretical knowledge and mechanical training.

Methods of adjustment are but a means to an end and depend entirely upon the operator. The mastery of an appliance may take years. It becomes efficient in one man's hands and is inefficient in another's. I believe the tendency has been to change our methods of treatment too often, according to popularity of new types of appliances. We are best able to evaluate our successes and failures if we have a standardized treatment for similar types of malocclusions, and use it judiciously.

185 E. State Street.

PRELIMINARY REPORT OF A CASE INVOLVING LOSS OF ROOT SUBSTANCE

History and Treatment

Francis W. Nash, D.D.S., Scranton, Pa.

History.—The patient, a girl 16 years of age, presented a marked maxillary protrusion. She had had previous treatment with appliances for approximately three years without improvement being noted in the condition. In this period the maxillary right second premolar was removed to aid in the correction. Loss of root substance, resorption, was determined toward the end of this period and extraction of these teeth was advised. The parents objected and upon consultation with a rhinologist were referred to the writer for orthodontic treatment.

The child was extremely nervous and her physician advised that this condition would be helped if the teeth could be corrected. She was quite unhappy about her dental situation.

The maxillary incisor teeth were extremely loose. The mandibular left first molar was seriously carious and the parents were advised of the need for a new restoration and of the precarious vitality of the tooth. They were also told that some further resorption was likely to occur but that it was likely that the anterior teeth could be moved to improve function and esthetics and in all probability would serve for a number of years. A thorough physical examination was ordered as a condition of treatment, and the parents were advised that neglect to follow any needed medication would jeopardize the chances of making any improvement. Results of this examination are given under the section on diagnosis.

Etiology.—The thumb-sucking habit combined with a lack of function in the bottle feeding and the condition of rickets, are believed to have been the important factors in producing the original deformity.

Regarding the etiology of the marked resorption of the maxillary anterior roots as indicated by the dental radiographs, there was undoubtedly systemic involvement but a most important contributing factor also was the extreme dysfunction of these teeth. In any masticatory action they received a force over a long period of time, certainly not conducive to their health. There probably was, and is, some resorption in the roots of the other teeth, but it is not grossly evident in the dental radiographs.

Diagnosis.—Gnathostatic denture reproductions, photographs, and lateral radiographs of the head as well as dental radiographs were made.

Read before the American Association of Orthodontists, April, 1939, Kansas City, Mo.

In relation to the median raphe plane the denture reproductions showed the arches were slightly asymmetrical with slight contraction anteriorly. In relation to the orbital plane, the denture was anterior to normal anteroposterior relationship to the skull; there was a maxillary anterior dental protraction. The molar teeth on the right side had moved forward toward the orbital plane.

There was a general lack of muscle tone.

The results of the physician's examination showed anemia, need for calcium and phosphorus, and thyroid slightly subnormal.

Copies of the reports on the case at the time treatment was to be undertaken are presented.

COPY OF HISTORY OF ———

Name——— Referred by Dr.———
Address——— Age 16
Occupation—Student

Single.
Date—Feb. 8, 1938
Operations—None. *Injuries*—Broken leg.
(Patient has one sister and brother perfectly well. *Was a premature child.*)

Diseases—Rickets, Measles. *X-ray*—Mouth.
S. Fever—No.
Rheumatism—No. *History of Cancer*—Yes.
History of T. B.—No. Grandfather died from cancer.
Patient is going to school.

Chief Complaint.—One month went blind for a minute. Very nervous. Always nervous. Sleeps well. Almost too much. School is difficult. Urine average. Bowels regular. Colds infrequently.

Coffee—No. Tea—1 to 2 cups. Smoke—No. Alcohol—No.
Painful joints—No.
Polyuria—No. Polydipsia—Occ. Nocturnal Enuresis—No. Dysuria—No.
Weakness—No. Itching Skin—No.
Weight—About same. Appetite—Good.
Nervous—Yes. Sleeps—Good.
Weather preferred—No preference. Tongue Sore—No.
Dyspnea—No. Palpitation—No.
Cardalgia—No. Edema of ankles—No. Of eyes? No.
Cough—No. Blood Spitting? No.
Night Sweats—No. Frequent colds—No.
Gas—No. Sour Eructations—Occasionally.
Epigastric pain or burning—No.
Worse 1 to 2 hours after eat? No. Relieved by eating? No.
Nausea—No.
Vomiting—No.
Constipated—No. Diarrhea—No. Blood in stool—No. Hemorr? No.
Pain in rt. hypo—Occ. Stabbing pain? No. Transmitted? No.
Chills—No. Jaundice—No.
Indigestion—No. Color of stool—Normal.
Headaches—Occ. Dizziness—Occ. Vision—Fair.
Falling hair—No. Frequent sore throat—No.
Stabbing pain in left lat.—No. In rt?—No. Blood in urine—No.
Menst. Reg? Yes. Pain? No. Date January 27. Days—3. Start—15.
Stopped—Jan. 30. Clots—No. Hot flashes—No. Cold? No.
Profuse—No.

COPY OF PHYSICAL EXAMINATION OF ———

Pulse Rad. 72 (Regular) Apical pressure—110/70
Temperature—97° F. Time—12:27 Hemoglobin—74.
Arteries—Negative.
Height—66" Weight—125½ N. Wt. 126.
Eyes—Negative. L. & A.—Yes.
Teeth—Protrude.
Thyroid—Negative.
Adenopathies—Negative.
Tremor—Negative. Fingers—Negative.
Breasts—Negative.
Heart—Negative.
Lungs: Chest Movement: Harsh breath sounds.
Abdomen—Negative.
Chief Complaint: Teeth. Went blind for an instant.
Diagnosis.—Anemia. Needs calcium, phosphorus, vitamins D and C.

℞ Dicalcium Phosphate with vitamin D.
(One three times a day before meals.)
℞ Tab. Cevitamic Acid 0.025 T. I. D. P. C.

Fruits, vegetables, beef, and liver.
Needs a basal metabolism and complete blood count.

LABORATORY REPORTS OF ———

Feb. 10, 1938—Blood Sugar, 90 mg. (Normal 125 to 130 mg.)
Feb. 10, 1938—Blood Phosphorus, 3.7 mg. (Normal 2 to 5 mg.)
Feb. 10, 1938—Blood Calcium, 10 mg. (Normal 9 to 10 mg.)
Feb. 11, 1938—Complement Fixation Test for Syphilis—
Noguchi Antigen—Negative.
Cholesterin Antigen—Negative.
Kahn Antigen—Negative.
Feb. 16, 1938—Basal Metabolism, Minus 12.

COPY OF LABORATORY REPORTS OF ——— (LAST EXAMINATION)

Basal Metabolism—April 1, 1939
Basal Metabolism Rate—15
March 27, 1939—Blood Phosphorus—4.5 per cent
(Normal—3.2 to 4.3 per cent)
Blood Calcium—6 mg.
(Normal—9 to 11)
March 28, 1939—Sedimentation Time—?
Sedimentation Index—8
Diagonal Line—Quiescent to slightly active.
March 25, 1939—Tuberculin Test—Negative.
March 27, 1939—Complete Blood Count

Hemoglobin—85
Color Index—0.9
Red Blood Cells—4,690,000
Leucocytes—11,600
Small Lymphs—17
Large Lymphs—10
Large Monocytes—0
Transitionals—0
Polymorphonuclear Cells—73
Eosinophiles—0
Basophiles—0
Myelocytes—0
Nucleating Reds—0
Anisocytosis—0

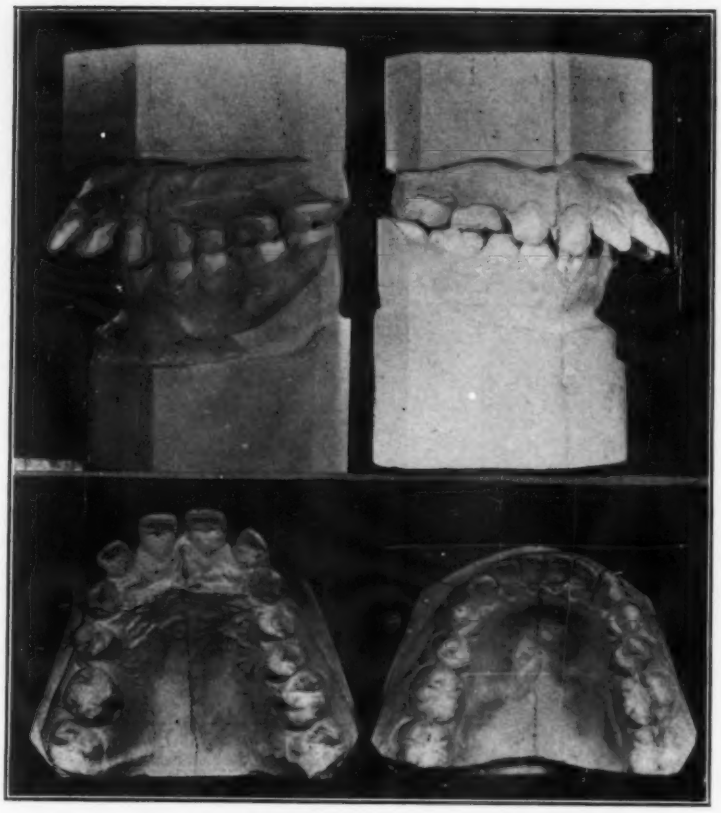


Fig. 1.—Models prior to treatment.

Fig. 2.—Patient prior to treatment.

Fig. 3.—Models of case one year after appliance therapy was started.

Fig. 4.—Patient one year after appliance therapy was started.

Excerpt From Physician's Report.—"This patient was started out on a fairly heavy calcium and phosphorus therapy regardless of the normal calcium and phosphorus in the blood, and also, with vitamins C and D, which I felt was indicated. After performing a basal metabolism, I found her thyroid to be slightly below normal, and this was given moderate treatment. She is anemic

and is getting a moderate dose of iron and liver extract for her blood and a maintenance dose of calcium and phosphorus and vitamin D.''

Treatment Therapy Employed.—In view of the history it was decided to concentrate on correction of the maxillary anterior dental protraction, correction of the maxillary right posterior teeth and to harmonize the arch forms.

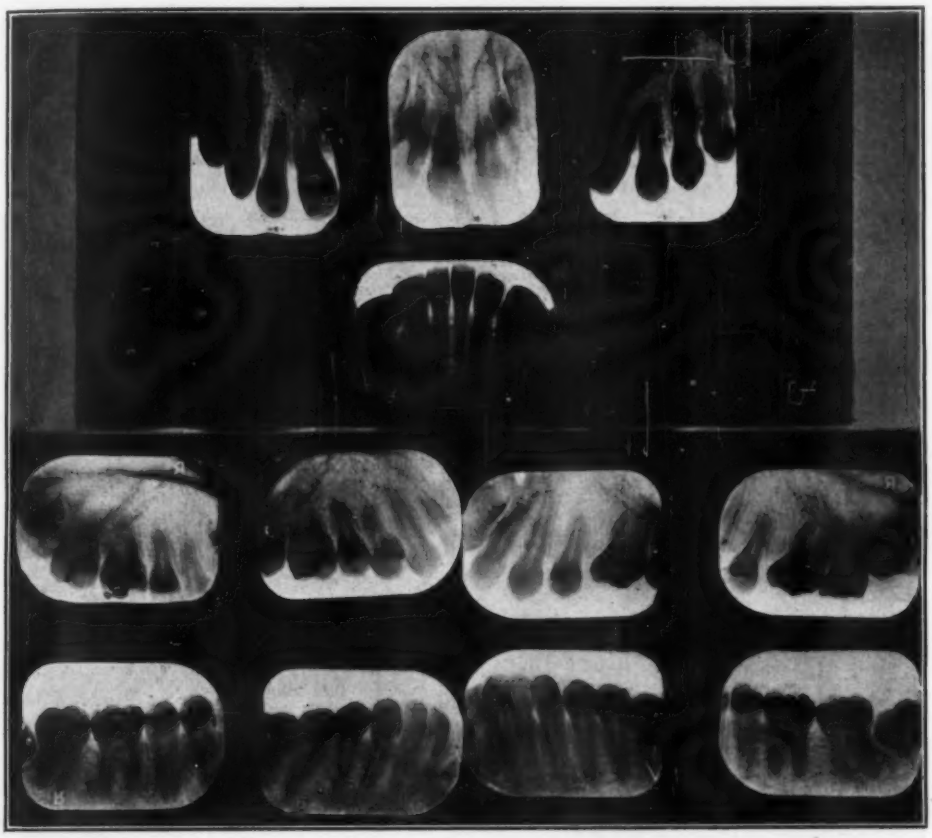


Fig. 5.—Radiographs of teeth prior to treatment. Marked resorption appears in maxillary incisor teeth only.

Upper teeth.—In March, 1938, the following appliances were placed. Molar bands, 0.006 inch by 0.017 inch, with ribbon arch tubes buccally, were made. Angle bracket bands were placed on canines, lateral and central incisors. A plaster impression with these bands in place was taken to construct a Lourie high labial arch, using ribbon arch wire for the base and auxiliary wires of 0.020 inch round wire extending to each of the brackets. The right side of base wire was diminished slightly in size to slide in the buccal tube of the maxillary right first molar band and to bring rotation of this toooth. Hooks for intermaxillaries were attached to base wire just distal to the canines. The auxiliary wires for the canines were arranged to allow distal movement of the appliance.

Lower teeth.—Molar bands, with ribbon arch tubes buccally, and 0.038 inch round wire sections soldered to the lingual surfaces and extending to mesial of

the mandibular first premolars, were made for the first molars. Angle bracket bands were placed on both mandibular canine teeth. A labial arch wire made up of ribbon arch sections from molars to canines, the sections soldered to 0.022 inch round wire for the anterior section, was used.

Large intermaxillary elastics were started on both sides and were worn day and night from March 28 to June 18. Elastics were then worn at night only.

In June also the Lourie high labial arch was removed and a labial arch consisting of ribbon arch wire from molar to canine on each side, soldered to an 0.020 inch round wire section for the incisor teeth, was placed. Intermaxillary hooks on this wire were soldered to be immediately anterior to the brackets on the canine bands. Intermaxillary force was continued at night only.

Fig. 6.—Radiographs of teeth after one year of treatment. Resorption of roots of anterior teeth does not appear appreciably greater.

Intermaxillary elastics were discontinued entirely in November, i.e., five months later. The rotation of the maxillary right first molar was proceeding slowly, and it was to give support to this appliance action and not permit any adverse action elsewhere, as well as to prevent any relapse during sleep, that the elastics had been continued. Tonic lip exercises had been prescribed but were not being carried out.

Most of the appliances were removed in March, 1939, to secure further gnathostat reproductions and radiographs, and to determine further appliance

therapy. It was not proposed to again place bands on the maxillary incisor teeth, but teeth requiring rotation were to be banded to complete the active appliance therapy.

A further physical examination was asked, and the results of it indicated the value of checking on these phases.

Fig. 7.

Fig. 8.

Fig. 7.—Left lateral radiograph of the head at beginning of treatment.
Fig. 8.—Right lateral radiograph of the head at beginning of treatment.

Results Achieved.—While at the time this report is being made the case is under active treatment and a good occlusion has not yet been attained, a much better functioning one has been. The gnathostat denture reproductions and lateral radiographs of the head indicate that the entire denture is anterior to normal in relation to the skull. The anterior dental protraction has been remedied to the extent of allowing these teeth to function. The teeth are firm in their sockets. Dental radiographs taken at this time indicate that no appreciable further resorption has occurred.

There has been very poor cooperation in the performance of exercises to improve muscle tone.

Quoting from the physician's report on the last physical examination, "The basal metabolism was still low because the patient had stopped taking the thyroid which we had advised. This was started again. The calcium had dropped. This was also started again. Her blood count was fairly good."

Prognosis.—It is believed that the result will be favorable enough to have made the treatment worth while. Some periodontal trouble may develop in later years because of, among other things, the anterior relation of the denture to the skull.

Fig. 9.—Lateral radiograph of head after one year of appliance treatment. It is conceded that all lateral radiographs shown would have been more helpful had they been taken with one of the head positioning devices.

OBSERVATION AND CONCLUSION

The peculiarity of the process of resorption is one of the reasons for making this report. The teeth in which pronounced resorption was evident were notably out of normal function. Had the case been original with the writer, the procedure would have been to move the entire maxillary denture posteriorly. The circumstances prevailing at the start seemed to make this course unwise.

Occipital anchorage was not deemed suitable to use in view of the general condition of the patient.

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Erratum

On page 884 of the September issue of the JOURNAL in the article, "Considerations on the Mechanics of the Pin and Tube Appliance," by Dr. Peter Adler, the last part of the first line on the page should read "It forms the angle ρ."

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Edited by

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ETIOLOGY OF DENTIGEROUS CYSTS, MULTILOCULAR CYSTS, ODONTOMAS, AND ADAMANTINOMAS

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INTRODUCTION

CLINICAL, roentgenologic, and histopathologic study of a large series of cases of dentigerous cysts, multilocular cysts, odontomas, and adamantinomas has disclosed a number of facts having a direct relationship to the etiology of these tumors.

1. These tumors occur most often in the mandible.

2. These tumors occur most often in the third molar and canine areas.

3. These tumors occur in conjunction with impacted, unerupted, partially impacted, and partially unerupted teeth.

4. There is no record in the literature of any one of these tumors occurring in a mouth with a full set of erupted teeth, unless there was present an impacted or otherwise malposed supernumerary tooth.

Thoma[1] believes that a follicular cyst can occur without the presence of a tooth. He believes that an outgrowth from a dental follicle can take place giving rise to a follicular cyst in the first, second, or third molar area.

5. These tumors occur in a mouth with a full set of erupted teeth where there is a history of a supernumerary impacted, unerupted, partially impacted, or partially erupted tooth having been extracted at some time or other.

In view of these singular findings, an investigation of the dental follicle or sac was made to determine its relationship, if any, to the formation of these tumors.

The dental follicle was considered because:

1. Every completely impacted and completely unerupted tooth must have a complete dental follicle.

2. Every partially impacted and partially unerupted tooth must have a part of a follicle over that area of the crown of the tooth which is within the hard or soft structures.

If it is true that these tumors occur at the site of, or in association with, unerupted, impacted or partially erupted teeth, it seems inconceivable that they can arise from the tooth structure itself. However, it does seem conceivable that these tumors can arise from such structures which contain the elements necessary to form such entities.

The structure most apt to contain such elements is the dental follicle, and with this in mind it was studied.

THE DENTAL FOLLICLE

To understand its origin, function, and end result, the embryology of the dental follicle must be reviewed.

The tooth structures are derived from the ectoderm and the mesoderm. The dental follicle arises from the mesoderm and entirely surrounds the embryonic tooth which consists first of an enamel organ and dentin papilla.

Lewis and Stohr[2] state: "After the crown of the tooth is well developed, the epithelial sheath, which separates the follicle from the enamel, disintegrates. Fragments of the epithelial sheath may remain in the follicular connective tissue." Other histologists have called attention to epithelial inclusions which may at times be found in the dental follicle.

As the tooth roots develop, the follicle becomes attached below the cementoenamel junction and remains intact until eruption through the alveolus and oral mucous membrane has taken place.

As the developing tooth fills the crypt, the follicle becomes thinned and consists histologically of internal and external fibrous connective tissue layers between which vascular connective tissue is found. The external layer of connective tissue is covered by a layer of oral pavement epithelium (Fig. 1).

Fig. 1.—Oral epithelium covering external connective tissue layer of dental follicle over an unerupted tooth.

DENTAL FOLLICLE WITH EPITHELIUM INCLUSIONS

We find that the normal dental follicle is composed entirely of connective tissue. Occasionally, islands of epithelial cells can be demonstrated in a follicle. There are three sources for these inclusions; remnants from the disintegrating epithelial sheath, embryonic ectodermal inclusions in the mesenchyma from which the follicle develops, and inclusions of cellular elements from the enamel organ (Figs. 2 and 3).

Most of these epithelial inclusions are undifferentiated cells. They are difficult to classify histologically. Some of them resemble ameloblasts, while the epithelial inclusions in other follicles resemble undifferentiated squamous cells.

It is conceivable that any irritation of the dental follicle, such as trauma or long continued pressure during the process of eruption may result in proliferation and multiplication of the enclaved cells, resulting in the formation of the specific tumor represented by these cells in the process of differentiation.

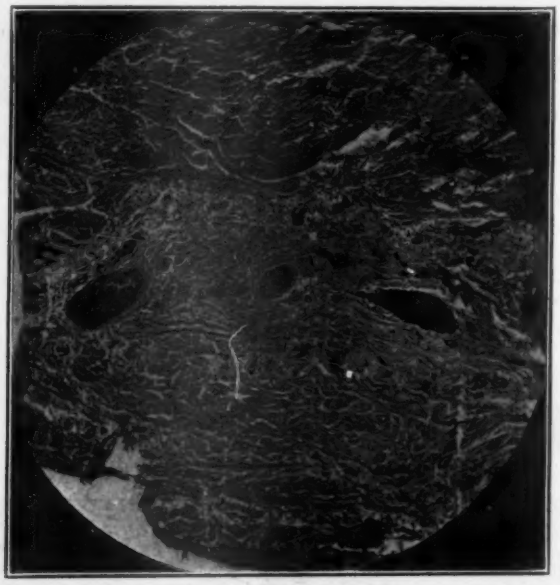

Fig. 2.—Epithelial inclusions found in follicle around tooth shown in Fig. 4 (low power).

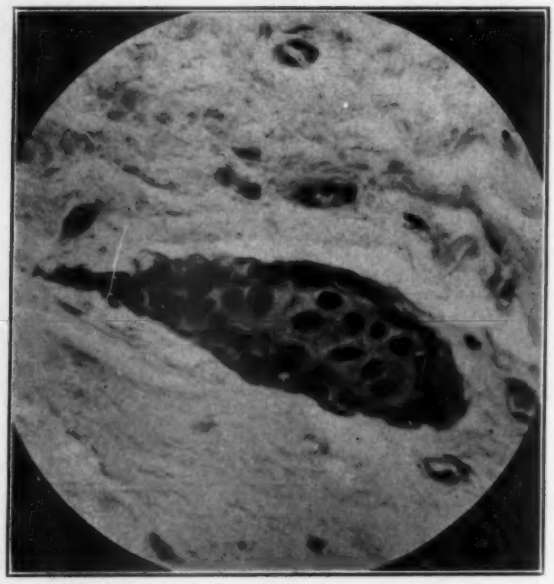

Fig. 3.—Epithelial inclusions (high power).

If the epithelial islands are derived from the primitive enamel organ and proliferation with tumor formation takes place later in life, we may expect to

encounter an enameloma or an adamantinoma, depending on those elements in the follicle necessary to produce one of these entities.

If an odontoma is to be formed, it is necessary to have not only epithelial inclusions which will form the structures of the tooth or teeth which are derived from the ectoderm, but also theoretically, we must have mesodermic inclusions from which the dentin and cementum are formed. We, however, have not been able to demonstrate such mesodermic inclusions.

Close examination, under high power, of the intercellular tissue in the epithelial inclusions reveals a type of structure from which it is possible that the mesodermic elements may arise.

If the inclusion cells differentiate into the type necessary to form either a dentigerous or multilocular cyst, then these entities arise.

"Embryologically the connective tissue cells of the dental sac will differentiate into cementoblasts, fibroblasts, and osteoblasts and form cementum, periodontal membrane, and alveolar bone respectively."[3]

We find, therefore, that the dental follicle may contain cells which possess all the elements necessary to form the constituent components necessary to make up a compound composite odontoma; that is, by proliferation due to some irritation, the elements necessary to form denticles, teeth, follicles, and interdental alveolar bone may be developed. Odontomas may be formed ranging from simple to complex type.

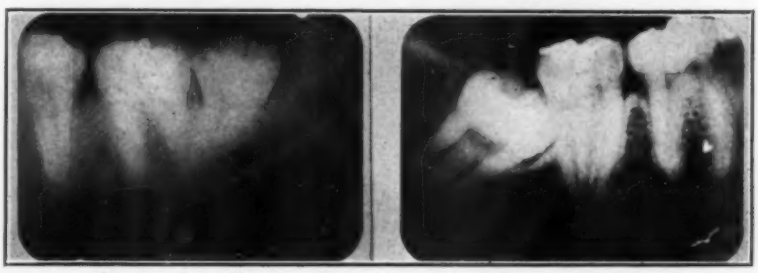

Fig. 4. Fig. 5.

Fig. 4.—Atrophy of follicle over erupted cusp.
Fig. 5.—Follicle covering unerupted portions of third molar.

FUNCTION OF THE DENTAL FOLLICLE

The function of the dental follicle is twofold. Embryologically, it aids in the formation of cementum and alveolar bone. Physiologically, it serves as a vascular medium for the nutrition of the developing tooth. It acts as a protective device against trauma during the process of eruption and may aid in eruption of the tooth by causing resorption of the overlying alveolus through the action of the osteoclasts.

END RESULT OF DENTAL FOLLICLE

As the tooth erupts, the dental follicle thins out. When the first cusp of a tooth breaks through the oral mucous membrane, that part of the sac which was over the erupted cusp forms the ligamentum circulare (Orban) (Fig. 4).

If the tooth erupts partially, the unerupted part of the tooth remains covered by the rest of the follicle (Fig. 5).

If a completely unerupted or partially unerupted tooth is removed and the dental follicle is not removed with the tooth but permitted to remain in the tissues, the follicle will atrophy or undergo fibrosis, if the ligamentum circulare fails to form.

If the follicle fails to disappear after the removal of the tooth and happens to contain epithelial inclusions, one of the four tumors named above may arise, if some form of irritation occurs to cause proliferation of these cells.

If irritation of the follicle occurs while the follicle and its tooth are completely or partially in their crypt, one of these tumors may arise if the irritated or stimulated follicle contains epithelial inclusions which will proliferate and differentiate.

The following clinical evidence is presented in support of the above contention.

Fig. 6.—Dentigerous cyst arising from third molar area following extraction of third molar.

CLINICAL EVIDENCE SUPPORTING THEORY THAT DENTIGEROUS CYSTS, MULTILOCULAR CYSTS, ADAMANTINOMAS, AND ODONTOMAS ARISE FROM PROLIFERATION OF DENTAL FOLLICLES CONTAINING EPITHELIAL INCLUSIONS

CASE 1, Dentigerous Cyst.—For a number of years, the patient, A. C., a male, aged 48 years, had had recurrent swellings with pain in the right side of the mandible. He was treated by his dentist several times for a subacute pericoronitis around a partially erupted mandibular right third molar. The dentist subsequently removed the tooth. Several years following the removal of the tooth, the patient noted a slowly increasing enlargement of the right side of the mandible for which he was referred for diagnosis and treatment.

X-ray.—X-ray examination disclosed a large, circumscribed area extending from the third molar area to below the sigmoid notch of the vertical ramus of the right mandible, consistent with a diagnosis of cyst (Fig. 6).

Diagnosis.—Dentigerous cyst.

Operation.—The cyst was enucleated and disclosed a thick membranous sac filled with semi-gelatinous fluid. The ventroinferior portion of the sac was degenerated in places.

Discussion.—It seems evident that the recurrent infection around the tissues of the partially erupted third molar was the irritating influence causing the transformation of the dental follicle into a dentigerous or follicular cyst.

CASE 2, Dentigerous Cyst.—Eight years ago, following the removal of an abscessed mandibular right second molar, patient, C. A., a female 53 years of age, had all of her teeth extracted and dentures constructed. One year later, she began to have discomfort and at times soreness in the mandible. Several months ago it had been called to her attention that her mandible was becoming noticeably enlarged. In the meantime she had to have frequent adjustments of her lower denture. For some time she had worn the lower denture infrequently.

Two months ago, her dentist, on examination, found fluctuating areas in the mandible and incised them with the return of a clear, straw-colored fluid. There was no recession in the size of the jaw.

Examination.—Examination disclosed a distinct enlargement of the mandible from the molar area on one side to the molar area on the other. There were several places where no buccal or labial bone could be felt. There was fluctuation in these regions. There was evidence of scarring where incisions on the labial surface of the anterior jaw were made.

X-ray.—X-ray examination revealed rarefaction of the mandible extending from molar area to molar area, with expansion of the anterior part. In the right mandible, there was a horizontally impacted third molar which showed an eroded surface of the crown. The outline of the follicle could be made out (Figs. 7, 8, and 9).

Diagnosis.—Dentigerous cyst.

Operation.—The cyst was enucleated and the impacted tooth removed (Fig. 10).

Microscopic Examination.—Microscopic examination revealed that the wall of the cyst was composed of collagenous connective tissue. One surface of the wall was lined by a single layer of flattened epithelial cells and several areas showed remnants of a stratified squamous covering. The entire wall was moderately infiltrated with lymphocytes and plasma cells. In several areas the surface was composed of granulation tissue which extended rather deeply into the wall. This was composed of loose fibrous tissue containing many congested capillaries and numbers of lymphocytes, plasma cells, and polymorphonuclear cells. There was no acute inflammatory reaction present. No remnants of any embryological tooth structures could be distinguished and no tendency toward malignant changes was seen (Figs. 11 and 12).

Diagnosis.—Dentigerous cyst with subacute inflammation.

Discussion.—It seems evident that the abscessed mandibular right second molar was the irritating influence causing the proliferation of the dental follicle of the impacted third molar into a dentigerous cyst.

CASE 3, Multilocular Cyst.—Ten years previously, the patient, M. Z., a male, aged 40 years, had a mandibular left partially erupted third molar removed because of recurrent infection of the tissues surrounding the tooth. For two years, he had had intermittent pain in the left side of the head and face. He was advised by his physician to have his teeth examined. X-ray examination by his dentist revealed an abnormality in the left mandible.

Examination.—The mandibular left third molar was missing. The second molar was loose but vital as disclosed by vitality tests. The rest of the teeth in the left mandible were not remarkable.

X-ray.—There was a large radiolucent area extending from the vertical ramus to the first premolar and from the ridge to the border of the mandible. The cortex on the border of the jaw in the third molar area was missing. In places, the radiolucency was punctuated by darker areas. Thinned-out septi surrounded these lesser regions (Fig. 13).

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 7.—Right side, dentigerous cyst arising from follicle of impacted molar.
Fig. 8.—Left side, dentigerous cyst.
Fig. 9.—Anterior mandible, dentigerous cyst showing expansion of the bone.
Fig. 10.—Dentigerous cyst from Case 2.

Diagnosis.—Multilocular cyst.

Operation.—The cyst was enucleated.

Microscopic Examination.—Microscopic examination of the cyst wall revealed it to be covered on one surface by a thin regular layer of stratified squamous epithelium. The superficial layers of this epithelium showed considerable parakeratosis, and in places, there was a large amount of piled-up keratin. Beneath the epithelium, the connective tissue consisted of densely arranged collagenous bundles, which were heavily infiltrated with lymphocytes and permeated by numbers of enlarged capillaries. A few monocytes were seen. In the deeper surface of one of the cyst walls, there was a fibrin deposition. A number of nerves, pigmented macrophages, xanthoma cells, epithelial pearls, and giant cells lay in this fibrous connective tissue. The giant cells contained a large amount of pink, homogeneous cytoplasm. There were cystic areas within the connective tissue, lined by a stratified squamous epithelium, containing a granular pink, purple material with an admixture of nuclear debris in their lumina.

Fig. 11.

Fig. 12.

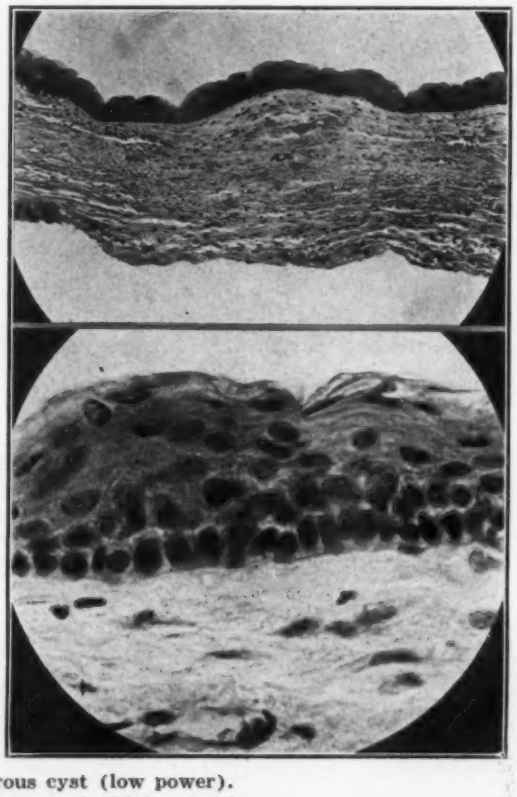

Fig. 11.—Dentigerous cyst (low power).
Fig. 12.—Dentigerous cyst (high power).

Diagnosis.—Multilocular cyst.

Discussion.—Evidently, recurrent pericoronitis had caused sufficient irritation of the dental follicle to result in proliferation. The tooth had been extracted, but evidently the dental follicle had been permitted to remain. Assuming that this follicle contained epithelial inclusions of the type differentiating into a multilocular cyst, it is conceivable that, if the follicle had been removed at the time of extraction, the cyst would not have been formed.

CASE 4, Odontoma.—The patient, H. T., was a male, aged 26 years. Several years ago it was called to his attention that he had no right mandibular canine and first premolar. He did not remember ever having had these teeth extracted. He had been told, however, that the mandibular right side was larger than the left.

X-ray.—X-ray examination disclosed a mass in the right side of the mandible composed of a vertically unerupted canine, a deeply impacted premolar and several fully formed supernumerary teeth. The mass was surrounded by a clearly defined radiolucent ring appearing to have its origin from the impacted premolar (Fig. 14).

Diagnosis.—Odontoma.

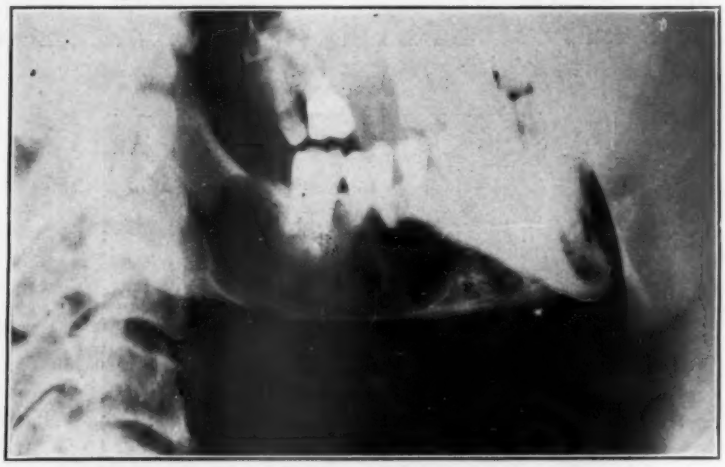

Fig. 13.—Multilocular cyst arising in posterior mandible following removal of mandibular left third molar.

Fig. 14.—Odontoma apparently arising from follicle of impacted premolar.

Microscopic Examination.—The follicle removed from the impacted premolar was examined. The section was made up of dense fibrous connective tissue with underlying layers of loose vascular connective tissue. There were sev-

eral islands of epithelial cells entirely surrounded by connective tissue. Some of the epithelial cells were somewhat cuboidal in appearance and others squamous in character (Figs. 15 and 16).

Discussion.—The dental follicle from the impacted tooth of this odontoma and the follicles from the impacted teeth of other odontomas were found to contain these epithelial inclusions. Hypothetically, when remnants of mesodermic origin are also present, we have all the elements necessary to form denticles or teeth, and anything which may cause proliferation of these undifferentiated cells may cause the formation of an odontoma.

Fig. 15.

Fig. 16.

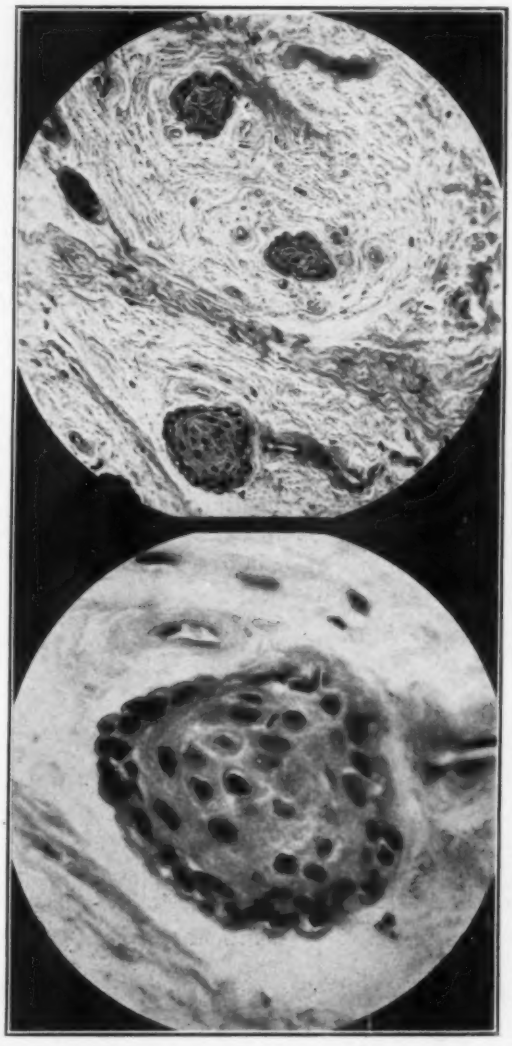

Fig. 15.—Epithelial inclusions found in follicle of impacted premolar from odontoma (Case 4).

Fig. 16.—Epithelial inclusions (high power).

Case 5, Odontoma.—The patient, M. S., a female, aged 35 years, had long noted the absence of her mandibular right molars but had paid no attention to it. In the last year or so, it had been called to her attention that the right side of her mandible was larger than the left. This prompted her to seek consultation.

Examination.—Examination revealed a visible enlargement of the right mandible. Intraoral examination disclosed buccal and lingual bulging of the right mandible in the molar area. The mass was hard and nontender and extended from the second premolar to the area anterior to the retromolar triangle.

X-ray.—There was a dense radiopacity extending from the second premolar to an unerupted third molar in the ramus. There was a horizontally impacted molar in the inferior border of the mandible, directly under the radiopaque mass. This mass seemed to arise from the dental follicle of this molar and appeared to be made up of small densely circumscribed areas surrounded by more or less radiolucent markings (Fig. 17).

Diagnosis.—Odontoma.

Operation.—The mass was found to consist of hundreds of denticles ranging from the size of a pinhead to the size of a grain of rice. Both the buccal and lingual cortices were studded with these denticles which protruded as far as the periosteum of the bone.

The entire mass was removed as far as the horizontally impacted molar, which was left to act as a splint against possible pathologic fracture of the jaw.

Some of the denticles appeared to be composed entirely of enamel, while others appeared to be composed of dentin and enamel. Some of the larger denticles had tiny dental follicles attached to them, which were surrounded by pinpoint enamel formations.

Fig. 17.—Odontoma arising from follicle of horizontally impacted molar

Discussion.—It seems evident that some irritation of the dental follicle surrounding the horizontally impacted molar caused proliferation to occur, with formation of this diffuse odontoma. The fact that pinhead denticles surrounded each of the dental follicles within the mass is further evidence of the possibility of the dental follicle containing these elements necessary to form such an entity.

Case 6, Adamantinoma.—The patient, A. T., a female, aged 23 years, had been deaf and dumb since childhood. Her family noted that her mandible had "something wrong with it" eight years ago. She did not complain of pain or discomfort. For the last two years, her jaw had progressively enlarged until it had become so noticeable that consultation was sought.

Examination.—Examination disclosed a large buccal and labial bulging of the mandible from the molar on one side to the molar on the other side. In places the bone was parchment-like, and in other places no bone could be felt. The labial plate was entirely missing, and there was some fluctuation. There was marked expansion of the anterior jaw.

Fig. 18.

Fig. 19.

Fig. 20.

Fig. 21.

Fig. 18.—Adamantinoma, right side, arising from follicle of impacted canine.
Fig. 19.—Adamantinoma, left side, Case 6.
Fig. 20.—Adamantinoma; note impacted canine in symphysis.
Fig. 21.—Excised tumor with horizontally impacted canine "in situ."

X-ray.—X-ray examination revealed a marked radiolucency of the entire mandible from molar to molar. The anterior jaw was markedly expanded, and there was a horizontally impacted canine in the inferior border of the symphysis. The radiolucency was not clearly demarcated and dipped into the lower border of the right mandible (Figs. 18, 19 and 20).

Dental films showed a series of small cystic areas separated from each other by short, broad, radiopaque septi.

Diagnosis.—Adamantinoma.

Operation.—The tumor was removed by enucleation, followed by cauterization. The tumor was found to be continuous with the dental follicle of the impacted canine (Fig. 21).

Fig. 22.

Fig. 23.

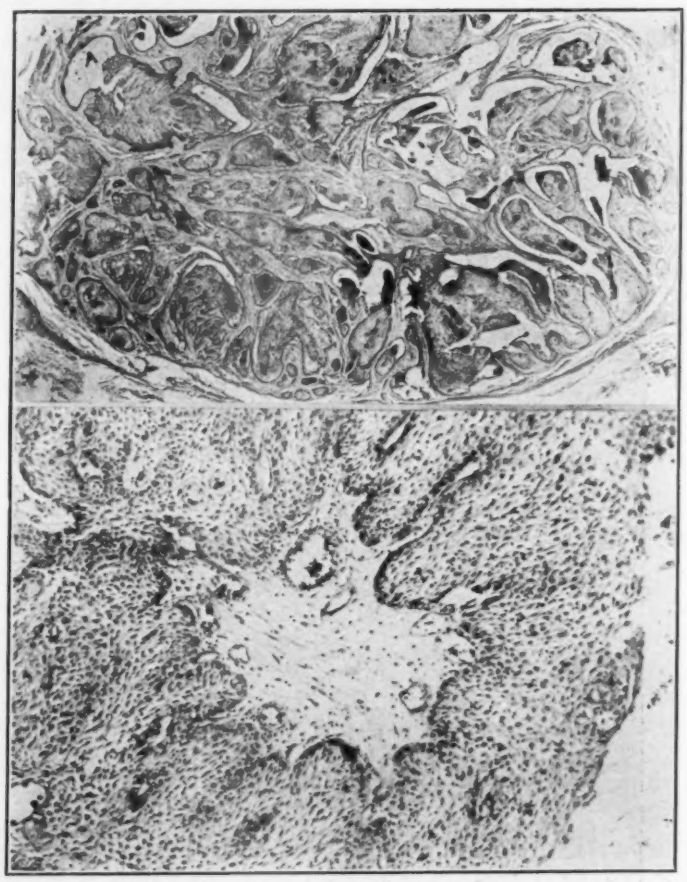

Fig. 22.—Shows variability in size of masses of tumor cells, well-developed but variable amount of stroma.

Fig. 23.—Actively growing region; poor differentiation of enameloblast layer.

Microscopic Examination.—Microscopic sections were made from six different portions of the tumor. They were essentially similar, but presented slight variations. The proportion of tumor and stroma varied somewhat in different regions, but in no place was the stroma very abundant. In some areas the tumor cells, however, were found in large sheets with very meager stroma. In one place the periphery of the tumor was included in the section, and the edge of the tumor was well demarcated, but there was no tendency to encapsulation. Just outside the tumor a small spicule of normal bone was seen. A few places showed diffuse degenerative and necrotic changes, and here the tissue had a general eosinophilic tinge. Here, there were also some congestion and hemorrhage and foci of polymorphonuclear infiltration.

The degree of differentiation of the tumor cells varied considerably throughout. In the best differentiated areas, the picture was that of a compact mass of tumor surrounded completely by fibrous tissue stroma. These masses of tumor cells were very variable in size, and very pleomorphic in shape (Fig. 22). They all had the same general internal structure, however. There was a peripheral enameloblast layer of cells, in contact with the stroma, which were high cuboidal cells packed together tightly (Fig. 23). There was a definite tendency for these cells to be vacuolated, and where this was most marked, the nuclei were displaced away from the basement membrane. This vacuolization of the enameloblast layer appeared as a transition step to the next deeper layer, namely, the so-called stellate reticulum zone. In most of the tumor, the latter

Fig. 24.

Fig. 25.

Fig. 24.—Well-differentiated enameloblasts; beginning cyst formation, early "pearl" formation.

Fig. 25.—"Pearl" formation (high power).

layer comprised the bulk of the cells. Here there was a very loose structure composed of what appeared to be a reticulum of stellate cells. The spaces (or vacuoles) between the cytoplasmic fibrils were usually larger than either the cytoplasm of the cells or the nuclei. The nuclei of the stellate cells were very similar in appearance to those of the enameloblast layer, but were slightly more rounded. Both had a fairly dense, rather finely divided chromatin network and

a definite nuclear membrane. Mitotic figures were very scarce in these cells. Toward the center there was a change toward keratinization. In many places this happened in several independent foci, in the same mass of cells. Sometimes, these independent foci could be seen to fuse. This keratinization changed in the direction of a swelling, hyalinization, and marked increase of eosinophilic staining of the cytoplasm of the stellate cells. This change resulted in the closer packing of these cells with the obliteration of the spaces between the stellate fibrils. This close packing resulted in a definite tendency to whorl formation (Figs. 24 and 25). With this packing there were distortion and fusion. Where it was looser it appeared as if there were a layer of spindle cells between the stellate reticulum and the keratinized cells.

In most of the masses of reticulum cells there were areas of fusion of the above-described vacuoles to form larger empty cystlike spaces (Fig. 26). In some places this was so large that it extended to the periphery of the mass of cells, and was separated from the surrounding stroma only by the remaining layer of columnar enameloblasts. In a few spots an entirely different mechanism of cyst formation was exemplified. These were in places where there was a large proportion of tumor and a proportionately smaller amount of stroma. In such regions there appeared to be islands of stroma surrounded by tumor cells. In most areas the stroma was a very loose fibrillary tissue, poorly vascularized and containing a sprinkling of lymphoid cells. In these islands of stroma there was sometimes such marked edema that the whole had broken down into a cyst surrounded directly by the adjacent enameloblasts.

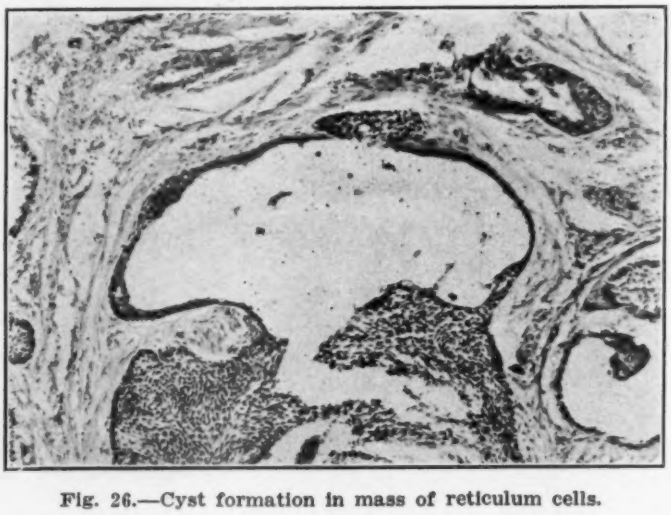

Fig. 26.—Cyst formation in mass of reticulum cells.

Diagnosis.—Adamantinoma of jaw (M. J. Schlesinger, pathologist).

Discussion.—Here again, we find a tumor occurring concurrently with an impacted tooth. Apparently some irritation of the dental follicle caused it to proliferate into an adamantinoma. In some of the dental follicles examined, the type of epithelial cells found in the inclusions closely resembled the cells surrounding the cystic areas of the adamantinoma.

Case 7, Adamantinoma.—At the age of 21, the patient, M. J., a female, aged 38 years, had had an impacted mandibular left third molar removed. Eight

years later she was operated on for the removal of a tumor mass in the left side of the mandible which was diagnosed as an adamantinoma. Two years ago she had some trouble with the left mandible but paid no attention to it. The jaw kept enlarging until she felt she needed consultation.

Examination.—Examination disclosed a visible enlargement of the left posterior mandible. Intraorally, there was a large mass in the third molar area extending upward into the ramus and forward to the premolar area. The mass was soft but nonfluctuant. In the third molar area no buccal plate could be felt.

X-ray.—There was a large irregular radiolucent area in the left mandible extending from the first molar to just below the coronoid process. In places the radiolucency was made up of small cystlike structures. The entire border of the vertical ramus and the ridge of the horizontal ramus as far as the first molar area were destroyed (Fig. 27).

Diagnosis.—Adamantinoma of jaw.

Operation.—The mass was removed by enucleation and cauterization.

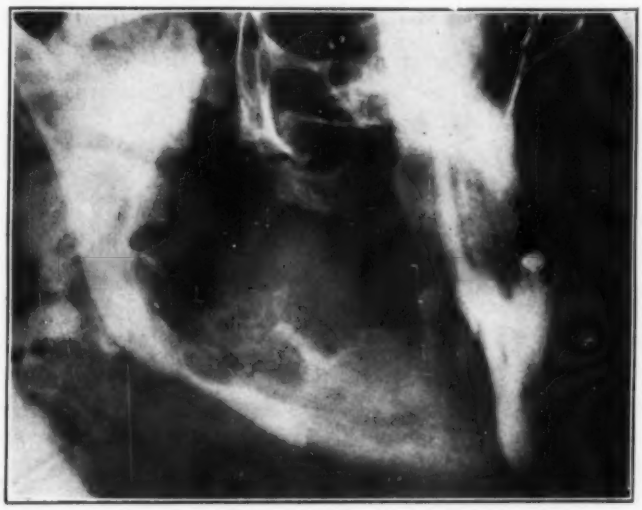

Fig. 27.—Adamantinoma occurring in area from which an impacted third molar had been removed.

Microscopic Examination.—Microscopic examination of tissue from the jaw revealed rounded structures composed of tissue such as is found in an adamantinoma. These rounded structures possessed at the periphery a palisade arrangement of the cells so that the cells were perpendicular with the border. Within the structure groups of squamous cells were seen, some of which were prickle cell in type. Definite epithelial pearls were noted. However, in these epithelial pearls numerous cysts had formed. Outside the epithelial pearls the tissue had assumed an edematous appearance, almost myxomatous in type with numerous stellate cells present. Some of the structures were so cystic that the cells had become flattened, while in other structures the cells were very compact. No epithelial cells were seen here, and no myxomatous tissue was noted. The stroma about these structures was very compact and was composed of bundles of acellular collagen fibers. The structures of the adamantinoma appeared to be invading this stroma. No mitotic figures were noticed. In one point the stroma was

covered by a moderately thick layer of stratified squamous epithelium which was not keratinized. The basal-cell layer was regular and well defined. The rete pegs were moderately prominent. A rounded, adamantinomatous structure could be seen in close proximity to this epithelium. In another area mucous gland tissue was noted. It was not remarkable.

Diagnosis.—Adamantinoma of jaw (M. J. Schlesinger, pathologist).

Discussion.—Here we find a history of an impacted third molar having been removed. The dental follicle was not excised and probably contained epithelial inclusions. Instead of the follicle atrophying, some irritation took place and resulted in proliferation with the creation of an adamantinoma.

CONCLUSION

A few cases have been presented from a large series of these tumors, each with a history revealing the presence or previous removal of an impacted or unerupted tooth, deciduous, permanent, or supernumerary.

If adamantinomas, multilocular, dentigerous cysts, or odontomas are formed from the dental follicle and epithelial inclusions, *an operation for the removal of an unerupted or impacted tooth is not complete with the mere removal of the tooth. The dental follicle or sac must be excised also.*

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311 Commonwealth Avenue

CONSERVATIVE MANAGEMENT OF IMPACTED OR UNERUPTED THIRD MOLARS

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A WIDESPREAD opinion held by laymen, and too frequently condoned by some dentists, is that third molar teeth are practically useless. Hence the extraction of such teeth, especially when symptoms are present, is rarely questioned.

The apparent indifference on the part of the general practitioner toward the third molar may be due to its relative inaccessibility, the apathy of the patient, the time and effort required to convince him that the third molar may be valuable, the fact that they are often overlooked, sometimes decaying before they are fully erupted. Lastly the impacted third molar not infrequently is the cause of serious trouble.

The third molar erupts later in life and is often one of the strongest teeth in the mouth. When some of the other molars have been lost the presence of a third molar may be very valuable. Many patients have fixed or removable bridges attached to third molars that have given excellent service for many years.

Dentists are well aware of the serious difficulties which may follow the extraction of a third molar, especially an impacted one. This subject has been covered adequately in the dental literature.

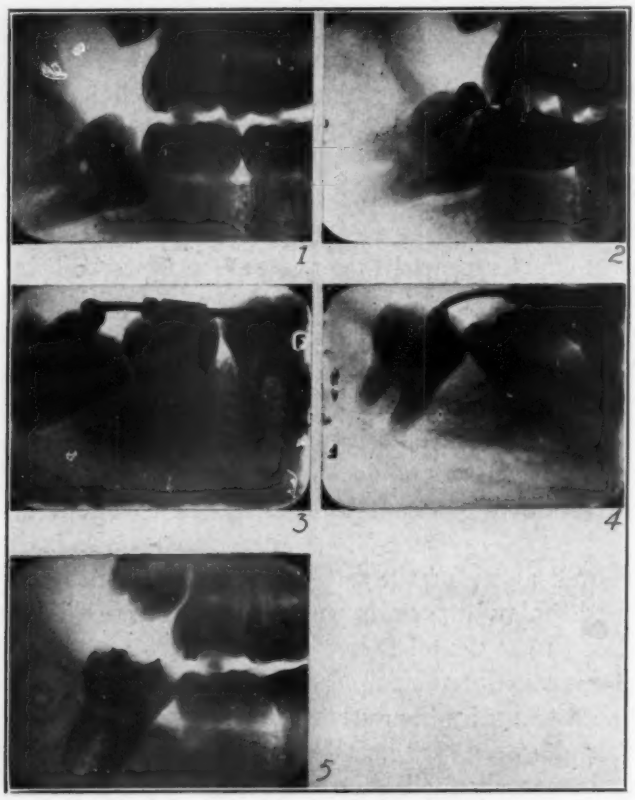
Repeated observation of the unpleasant and often serious results of extraction stimulated an attempt by the author to bring the impacted teeth into proper alignment. The results were very gratifying. Even if ultimate extraction seemed indicated, it was immensely facilitated.

A report of six representative cases follows:

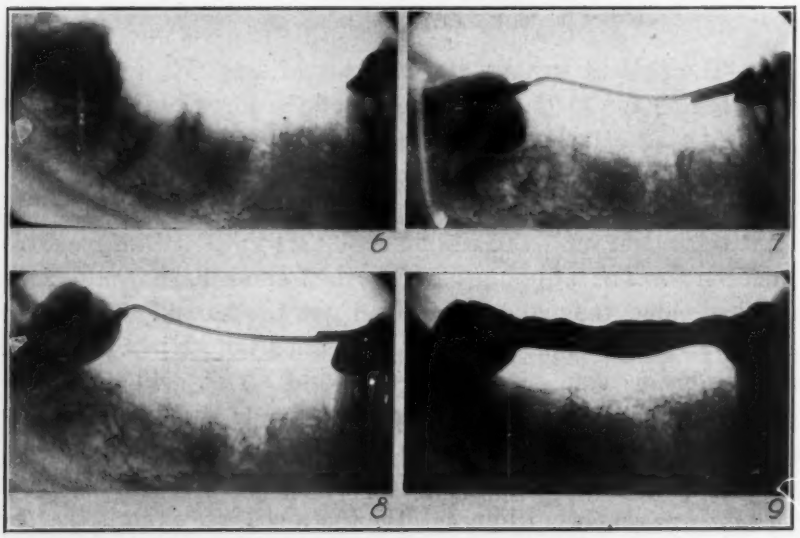
REPORT OF CASES

CASE 1.—The patient was a male, 22 years of age. Enough gum tissue was removed (novocain) to expose a distal cusp of the impacted tooth (Fig. 1). A 16g. pin, with a ring attached, was cemented into the tooth. Not knowing how much pressure would be required to move the tooth, a traction screw was connected and arranged to push instead of pull. The device was held in place by an orthodontic band around the second molar (Fig. 2). The results were not entirely successful. The appliance was rather cumbersome, and as the third molar started to move, the orthodontic band was pushed off. The work was discontinued for seven months because business called the patient to Europe. Upon his return an inlay was substituted for the band. This held the traction screw (Fig. 3), and in less than a month it was necessary to change the position of the attachment ring in the third molar (Fig. 4) and in five weeks the appliance was removed entirely. Fig. 5 is a diagnostic picture taken eight months later. Although the case was somewhat hurried, the tooth still seems to be perfectly vital, normal, and useful after four years.

CASE 2.—The patient was a male, aged 28 years. In this case the second premolar and the first and second molars had recently been extracted because of facial neuralgia, possibly due to pressure from the third molar (Fig. 6). The patient requested a partial denture. It was decided to try to bring the embedded third molar up into proper position. The patient was not aware that the tooth

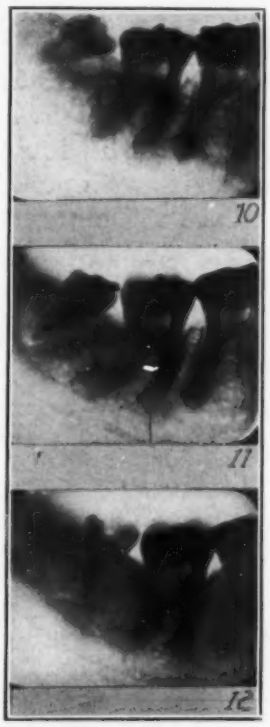


Figs. 1 to 5.



Figs. 6 to 9.

was still there, being under the impression that it had been extracted with the other teeth. A small amount of gum tissue was removed, as the tooth was entirely covered. The traction screw was impractical in this case. A rustless steel tube was cemented into the embedded third molar. A 19g. rustless steel wire was fitted into the tube without binding. The wire was carried forward and, the front end being bent back on itself (to prevent turning), rested in a recess in a filling in the first premolar (Fig. 7). The wire could be removed easily and bent so that it exerted pressure upward (a lever effect) on the third molar (Fig. 8). It required three months (with many interruptions) to bring the tooth up far enough to install a fixed bridge (Fig. 9). As the patient did a great amount of public speaking he was very grateful that a partial denture was avoided. The bridge has given excellent service for the past three years.



Figs. 10 to 12.

Figs. 13 to 15.

Case 3.—This was the only case with regrettable features. The impacted third molar was practically horizontal. The patient, a female, 24 years of age, had a great deal of pain at the tooth site. Unfortunately our early x-rays were destroyed by accident. One cusp of the tooth was exposed. A rustless steel tube was cemented in. A removable 19g. rustless steel wire was then inserted, as in Case 2, carried along the buccal surface of the mandibular molar, and allowed to rest on a small pin cemented into the buccal surface of the first molar. The symptoms of pain stopped immediately under the counteracting pressure of the wire, but the 19g. wire was apparently too heavy. The tooth moved very rapidly, with the result that it was devitalized and became painful again. The appliance was taken off at once (Fig. 10). The tooth was opened, and the root canal was treated and filled with a radiopaque antiseptic paste (Fig. 11).

In the meantime the tooth had continued to straighten itself without any artificial aid and moved from its position in Fig. 10 to the position in Fig. 12 in a period of seven months.

CASE 4.—The patient was a male, 21 years of age. It was now realized that although an impacted third molar appeared by x-ray to be very firmly fixed and difficult to move, in reality such a tooth required no more pressure than a fully erupted one. In this case the impacted third molar was too close to the second molar to insert a tube. Accordingly a traction screw was attached to the second molar in such a manner as to press against the occlusal surface of the third molar (Fig. 13). In three weeks the tooth moved a little way. A short 19g. wire to which was soldered a flat tube at a slight angle was then cemented into the tooth. A 24g. rustless steel wire, the end of which was bent back on itself, was fitted into the flat tube. This kept the wire from turning. The other end of the wire rested on a lug attached to a first molar. By cementing the flat tube at a slight angle, it was possible to bring the traction wire along the buccal surface of the teeth out of the way of occlusion. The principle of the method is shown in the diagram. Pressure could be applied in any direction desired by bending the traction wire (Fig. 14). Profiting by previous experience a six-month period was allowed to straighten this tooth (Fig. 15). This method was used in nearly all of the subsequent cases and proved most satisfactory. The same method was used even on a 75-year-old patient, with excellent results.

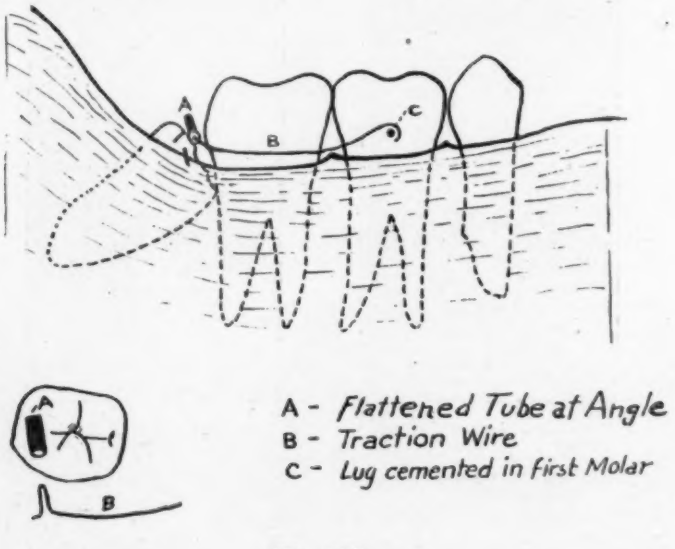


Fig. 13A.

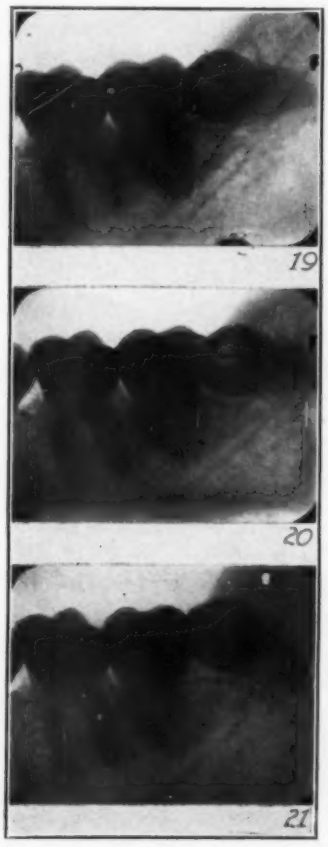
CASE 5.—A maxillary impacted third molar in a female, 36 years of age, caused considerable neuralgic pain. A 19g. wire with small ring attached was inserted (Fig. 16). Pressure downward and backward was obtained by means of a 24g. rustless steel wire, hooked into the ring, brought forward under a second pin in the occlusal surface of the second molar, and hooked over a third pin attached near the gum margin of the first molar (Fig. 17). The facial pain stopped as soon as pressure was applied. About eight months later the appliance was removed (Fig. 18).

CASE 6.—The patient was a female, 25 years of age. The mandibular third molar was entirely covered by gum tissue and had a cavity in the occlusal surface (Fig. 19). After removal of the gum tissue the same method was used as in Case 5, with the exception that no retaining ring was cemented into the third molar, but the 24g. rustless steel wire was bent so as to catch under the margin of the cavity (Fig. 20). There was no history of facial neuralgia, only occasional odontalgia. No attempt was made to straighten the tooth beyond the point where it could be properly filled (Fig. 21).

COMMENT

The chief disadvantages of the methods outlined above are twofold: The mechanical difficulty of attaching the appliance and the length of time required for treatment. However, contrasted with extraction, the procedure appears to have many advantages.

Figs. 16 to 18.



Figs. 19 to 21.

In cases of neuralgic pain the speed with which relief was obtained was striking. In every case pain was relieved as soon as tension on the unerupted tooth was applied, and in no case did the pain return after the embedded tooth was straightened.

The patient experiences no shock of operation. Even when the tooth is completely covered the overlying gum tissue is easily removed under local anesthesia.

Very rarely was bony tissue encountered in a position which interfered with the attachment of the pin and flat tube.

One of the chief criteria for appraising any treatment for embedded third molars should include an evaluation of the extent of permanent damage to surrounding tissues. From this standpoint the methods described here gave entirely satisfactory results, except in one case. Our later experience indicates that such complications can undoubtedly be eliminated by the avoidance of undue haste.

Surgical removal of an impacted third molar is contraindicated in certain patients. In such cases exposure and realignment of the tooth has obvious advantages because the removal of a straightened molar becomes a matter of simple extraction. The advantages of having a third molar available for fixed or removable dentures are too obvious to need further comment.

When this work was started it seemed that considerable pressure would be needed to move an impacted third molar. However, subsequent experience has shown that movement of such a tooth in an adult required little or no more pressure than is ordinarily employed in orthodontics in a child. One patient (not included in the present report) was 75 years of age. The proper alignment of an impacted tooth, if accomplished early enough in life, may be of considerable aid to correct articulation of the normally opposing molar.

SUMMARY AND CONCLUSIONS

1. A painless method is described for the treatment of impacted third molars by an orthodontic straightening procedure instead of extraction.

2. The patient experiences no shock of operation nor any permanent injury to surrounding tissue if manipulation is carried out slowly (4 to 8 months).

3. Neuralgic pain in all cases was eliminated immediately, and in no case did it return.

4. Apparently any impacted tooth can be moved by sustained pressure (regardless of age of patient), even if entirely covered by gum tissue.

5. The realigned third molar in many cases has been used successfully as an abutment for both fixed and removable dentures.

6. In the younger patient the method helps to balance the articulation and to prevent extrusion of the normally opposing molar.

7. If it is desirable to extract the tooth, the operation is immensely simplified.

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LESIONS OF THE TONGUE

Collective Review

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RADICAL operative removal of the tongue for carcinoma is seldom done at the present time, but it is interesting to note that a large number of authors recommend dissection of the cervical lymphatics if there is any promise of a local cure with radium or local operation (twenty-two articles of twenty-six reviewed). Such uniformity of opinion points to the conclusion, at least for the present, that dissection should practically always be done on the side of the involvement and that close watch should be kept on the opposite side so that it can be done there too at the first suspicion of metastasis. (This is not suggested as a critical review, but may be of some statistical or reference value to those interested in the work. Recognition is due to Dr. George Crile, two of whose articles are referred to here, because of his pioneer efforts in dissection of the neck for carcinoma.)

CARCINOMA OF THE TONGUE

Roux-Berger and Tailhefer[42] of the Curie Foundation of Paris, in a paper entitled "The Removal of Neck Glands in Bucco-Pharyngeal Cancer," state that the principle is exposure of the retrostyloid space to remove the jugular vein high and easily. They believe that neck dissections should always be done unless there is superficial or deep fixation of the glands. And in the cases involving the tongue, neck dissection is still more important and should be done early; and, furthermore, if it could be done routinely early, there would be fewer hopeless cases. The scar and disability are recognized as being bad, but they are of minor importance in the matter of getting rid of a cancer. The authors have removed the digastric muscle twenty-three times without trouble and have done 212 operations with only six deaths; all this before 1927.

Duval[17] from the Institute of Cancer of Paris, in an excellent article entitled "A Point of Technic in the Removal of Neck Glands for Cancer of the Tongue—The Operation from Back to Front," expresses the principle of exposing the retrostyloid space to get to the jugular bulb and removing all tissue in one block from the back, forward. This technique was used at The Institute of Cancer of the Faculty of Medicine of Paris for one year without a death and under regional block anesthesia.

Ducuing, Fabre, and Gouzy[15] of Paris, especially in carcinoma of the tongue, expose the retrostyloid space for the jugular ligation by cutting the upper end

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of the sternomastoid muscle away as well as the digastric and stylohyoid muscles. The importance of dissecting the whole neck in one block is stressed, and the anterior part of the digastric muscle is removed also.

It is the custom of Cooper[11] to treat the primary carcinoma of the tongue first and allow a period of about four weeks to elapse between the treatment of the primary growth and that of the cervical area. The reason for adopting this method, which has given satisfactory results, is based upon the necessity of giving the patient the best possible blood and lymphatic supply to the area treated. This is an all-important matter. The disappearance of the tumor is hampered by the removal of the lymphatics and ligation of the blood vessels, and is, of course, the object of the block-dissection operation on the neck. Therefore, the treatment of the neck is left until four weeks after the radium treatment of the tongue. The local lesion is treated with radium element needles of 1.33 mg. and the average total dose is 1,200 mg. hours.

The patient is instructed to appear for examination once every week for four weeks when the treatment to the cervical lymph glands is planned out. There is no doubt that, in the present state of radium therapy, surgery is to be given preference in treatment of the neck. The question does not arise if the glands are palpable. In such cases surgical removal is the treatment of choice. All enlarged glands are not necessarily malignant, but operation offers the best possible chance of preventing metastases. The debatable point is whether one is justified in doing a block dissection when glands are not palpable. In the author's experience, it appears that operation under local anesthesia is the safer method, and should be carried out in every case four weeks after radiation of the primary lesion. Any operation short of a complete block dissection has nothing to recommend it. The operation aims at removal of all glands (including the submaxillary), deep fascia, the sternomastoid muscle, and the internal jugular vein.

When glands are found on both sides, the operation is performed on the second side after the lapse of a fortnight, and obviously the internal jugular vein must be removed on the more affected side.

In inoperable cases complete surgical removal is impossible. It is the custom to bury needles and hope for the best. This procedure must often be supplemented by injections of snake venom, various hypnotics, and analgesic drugs.

Searby[44] maintains that, in the majority of cases of carcinoma of the tongue, death is indirectly the result of metastasis to the cervical glands. There is no doubt that x-ray therapy acts unfavorably toward the process of metastasis, but there is also much evidence that in many cases surgical excision with careful clean dissection will prevent metastases or, if they have already developed, will remove them. A cure will depend on the extent of the metastases and the amount of direct extension. The primary growth on the tongue can be cured by excision if the principles of cancer surgery are applicable. However, if radical surgery is not feasible and one wishes to avoid mutilating operations, it is necessary to fall back on the selective action of radium treatment. It seems that a proper dose of radium is capable of melting away grossly cancers of the tongue, even in those advanced cases in which surgical excision would not be possible.

Each case, however, must be treated individually. A hard and fast rule is not possible. The removal of all teeth before any treatment is started is advised, as this is the surest way of avoiding later infections.

Schurch,[43] on the basis of surgical and radiologic literature and of personal experience, gives a survey of present methods of treating oral tumors. Particularly in these tumors, a combination of therapeutic measures is applicable. Radiology and surgery share equal importance in this treatment. A close cooperation between these two methods of treatment may be of great value in the improvement of the heretofore ungratifying results of treatment. Schurch considers the routine biopsy not to be of great danger and the means of some prophylactic measures, such as clearing up precancerous formations (leucoplakia and erythroplasia). Under treatment he discusses electrosurgical methods, the application of radium (surface application, the implantation of needles, and distance radiation), and roentgen therapy. It is here distinctly emphasized that the aforementioned type of x-ray therapy is not less effective than electrosurgical treatment. The electrosurgical attack should be the first choice for small, well-localized tumors. Radium therapy in the form of implantation is limited in its use because of technical difficulties encountered. The large inoperable tumors are treated by x-ray therapy. Small tumors, especially those with a favorable prognosis, are to be treated surgically as radically as possible. In every case radical gland dissection of the glands should be done, preferably after x-ray therapy to the region. Only the few, very radiosensitive tumors are primarily treated with x-ray therapy.

Wookey[51] summarizes that in 54 per cent of the cases of carcinoma of the tongue, the primary disease was controlled by radiologic methods. Sooner or later in most patients there was an invasion of the regional lymph glands; and it is thought probable that surgical dissection of the glands might wisely be done before any enlargement can be demonstrated because this seems to offer the best hope of control of the disease in the neck. The results of treatment of other intraoral cancers are much more satisfactory than those obtained when the tongue is involved. Most of these primary lesions have disappeared under radium therapy and the results of early and radical dissection are encouraging. Operations for removal of portions of the jaw have proved of great value in the treatment of a good many of these cases and can be done fairly safely.

Donati,[14] immediately after biopsy and microscopic diagnosis, implants radium in the tumor of the oral cavity or pharynx. After at least thirty days, to allow for subsidence of all local and general reaction to radiation, the radioresistant lymph nodes in the neck are removed surgically. Two to three weeks later a course of x-ray therapy is given to the site of operation. Thirteen patients with tumors of the tongue, cheek, and tonsils were treated in this manner with good early results, but too recently to permit opinion as to recurrence. The very radical surgical management of the usually radioresistant lymph nodes of the neck is described in detail with many illustrations. Local anesthesia is used with intravenous dilaudid-scopolamine preoperative medication. If necessary, one may remove the posterior belly of the digastric and the stylohyoid muscles to gain the best access to the jugular bulb region. It is impossible to do this radical operation bilaterally at one sitting because of ligation of the internal

jugular vein and also because of complete removal of the sternomastoid muscle. The results with regard to *recurrence* will have to show whether this very radical operation is justifiable. In most instances, the lymph nodes behind the sternomastoid muscle are involved; furthermore, the supraclavicular and the submental glands must be removed since their status can be determined only histologically. Contraindications are retropharyngeal, surgically inoperable metastases, and invasion of or adhesions of the metastatic mass to the carotid artery. In addition, in the opinion of the author, one must exclude radium-resistant primary lesions of the buccal cavity and pharynx. The relatively metastatic-free cancers of the anterior half of the tongue may be exempt from this under careful observation. The method of treatment should be suited to the individual case.

Seemen[45] reports a case of a large carcinoma of the tongue with metastases in the floor of the mouth and in the submental region in a man 57 years of age. The patient had electrocoagulation of the growth four and one-half years ago, with removal in layers. The lymph glands were excised and since that time there has been no recurrence.

Stanford Cade[8] states Wallace's summary on glands:

1. If no glands are palpable, surface radiation is employed.

2. (a) If glands are palpable but operable, if the condition of the patient is good, and there has been a good, local response to treatment of the primary growth, they are removed by a block dissection. (b) If removal of glands is not advisable, open or closed needling (radium) is employed.

3. If the glands are inoperable, they are given primary treatment with deep x-rays followed by either surface application of radium or needling.

Results of radium treatment for all kinds and stages of cancer in a total of 337 cases: 33.5 per cent of the patients were well from seven to ten years.

In 225 cases with tongue involvement 33.3 per cent of the patients were well from seven to ten years; 18.7 per cent from five to six years, and 11 per cent for seven years. The author believes that mass radiation with from 2 to 6 gm. of radium is best although the method is still in development, and he states that "radiation is a purely local remedy and has no influence on the subsequent development or dissemination of the disease."

Chase[10] states that neck dissections should be done if the case is not too unfavorable locally; otherwise, x-rays should be used. No results are given.

New[36] gives the following results in 162 cases with involvement of the tongue:

		Five-Year Survival
Nodes negative, but dissected	59	29
Nodes negative, not dissected	40	19
Nodes positive, and dissected	57	8

Hutchison[26] advocates block dissection in operable involvements and as prophylaxis in practically all cases.

Crile[12, 13] has obtained five-year cures in 25 per cent of 549 carcinomas of the buccal cavity, in those cases which, after operation or radium treatment of the primary growth, underwent neck dissection.

Kaplan[27] uses radium treatment locally for carcinoma and then neck dissection if the nodes are movable and intact. When complete resection cannot be done, as much as possible is removed and the remaining malignant tissue is irradiated directly with radon or element of 200 mg. hours per c.c. of malignant tissue. No results are given.

Livingston and Lieber[30] recommend both surgery and irradiation in carcinoma of the tongue, but leave the question of metastasis to others and give no results.

Morow[33] presents a moderate departure from the usual present-day report on carcinoma of the tongue, in ninety-eight cases at the New York Post-Graduate Hospital.

His article is summarized, as follows:

1. All of the cases showed carcinoma microscopically and two-thirds of them were advanced. Neither size nor microscopic grading of the cancers proved of much prognostic value among the cases treated surgically; the operative mortality was 26 per cent, but during the last five years it has dropped to 16.7 per cent. The highest mortality was from 40 to 50 per cent and occurred in the cases with tongue and gland operation combined. Twenty per cent of all of the patients treated surgically survived five years or more; 32 per cent of those without node involvement and 11 per cent of those with node involvement revealed five-year cures. The best results were obtained when the two-stage operation was done, removal of the tongue first and then of the glands. Postoperative radiation was not used as a routine measure. Poor local results were obtained with radium and surgery, and *only 10 per cent primary healing with radium alone.* Five-year cures should be obtained in 30 per cent of the cases without node involvement; in cases with node involvement they will probably amount to less than 10 per cent. Successful treatment depends on keeping ahead of the disease and this should best be done by routine neck dissection whether the glands are palpable or not.

Eggers[19, 20] is one of the most enthusiastic authors in favor of neck dissection and he states that, even in carcinoma of the tonsil, surgery has a definite place in the early cases, and, as soon as the area is clean postoperatively, a radical neck dissection should be done on the side involved and then one on the opposite side if necessary. (No results are given.)

Berven,[2] in Stockholm, has used teleradium treatment in 457 oral cancers, with 25 per cent five-year cures. Teleradium is given first, then surgery or interstitial irradiation of the residual areas, and neck dissections are resorted to if the nodes do not disappear.

Forssell,[22] in Stockholm, reports 113 cancers of the buccal cavity, 75 per cent of which were inoperable but gave 18 per cent five-year cures with radium alone. In operable carcinoma of the tongue without gland involvement, radium treatment gave five-year cures in 55 per cent; operation in the same condition, in 41 per cent. Gland metastases, if inoperable, are treated by irradiation alone, preferably teleradium. If no glands are palpable, operation is not done but the teleradium treatment is used; however, Forssell had no patients with cancer of the mouth with gland metastases who became well with radiation treatment

alone. With combined surgery and irradiation seven of twenty of his patients remained alive for three years and two of five for five years.

Trotter[48, 49] reports pharyngeal growths cured by pharyngotomy, excision and neck dissection in some instances. He states that radium treatment might also be used, but he reports operative results because he knows most about them. An interesting explanation is given of late recurrences depending on loss of active immunity to parts of carcinoma left behind after from five to seven years.

Moure[34] gives the following late results of surgical treatment of carcinoma of the tongue: of fifty-seven patients operated on, twenty-three survived from two to six years.

Fraser[23] operated on sixty-eight cases of oral carcinoma without gland involvement, 23 per cent of which were reported cured after two years; of those with gland involvement, 3.8 per cent were reported cured after two years.

Pfahler and Vastine[37] treated 396 unselected carcinomas of the mouth (not including lips) with radiation with cures in 29 per cent, and with their present technique are obtaining 39 per cent. The authors think from 50 to 75 per cent of the patients should get well if treated properly by irradiation.

Blair, Brown, and Byars[4, 5, 6, 7] have made neck dissections a routine procedure in carcinoma of the tongue, and, although it would be best to be sure of primary healing from the treatment of the local disease, there have been enough inoperable extensions into the neck during a waiting period to indicate that the gland removals should be done soon after if not right at the time of the radium treatment. Both Butlin and Whitehead practiced preliminary gland removal before operating on the tongue, but this urgency has not been found necessary.

Stewart[47] advocates narrowing down indications for neck dissection and relies mainly on the interstitial treatment method of Janeway and Quick. He states further that nearly all patients come in for treatment with glands uninvolved or hopelessly involved.

Duffy[16] and Quick[40] present practically the same ideas as outlined under Stewart.

Holmes,[25] in fourteen statistical tables of the results of treatment of carcinoma of the tongue, presents the reports of eight large hospitals in the six largest provinces of Australia. These hospitals have for a number of years had a uniform system of recording cancer cases, and have carefully followed up the cases after discharge of the patients. This system of reporting cancer cases and following them up had its origin in 1929 after the government had distributed its radium. The statistics of the results in treatment of cancer are inclusive of the years from 1929 to 1932. The cases are divided on the basis of the anatomic site of origin and the extent of the disease, into the following groups:

1. Cancer which is limited to the tongue and shows no clinical evidence of involvement of the regional nodes.

2. Cancer in which the tongue and floor of the mouth are involved without clinical involvement of the lymph nodes.

3. Cases in which there is secondary involvement of the regional nodes clinically from a cancer of the tongue.

4. Cases in which the cancer of the tongue or floor of the mouth has invaded adjacent bone.

The number of patients falling into Groups 1 and 2 that were treated by surgery alone is relatively small; yet the results do not appear as favorable as in those treated by a combination of surgery and irradiation, or those treated by irradiation alone. Of 112 patients in Groups 1 and 2 treated by the various methods, 28 per cent were living from three to six years later; of 163 patients in Groups 3 and 4 only 7 per cent were living. Twenty-five per cent of those that died had no demonstrable metastases or recurrence. In 40 per cent of these the primary lesion of the tongue was probably healed, but the cause of death was secondary cancerous growths. In 65 per cent of the patients who died, therefore, the treatment was of value even though death ensued. Of 146 patients in Groups 3 and 4 who died, sixty-one had had healing of their primary lesion at some time, regardless of whether metastases or recurrence had taken place. Even if the treatment increased the life expectancy by only one or two years, a good part of the pain and suffering was alleviated by it. In closing, the author urges closer cooperation between the surgeon and roentgen therapist because in many cases the best results can be offered by combined surgical and roentgen treatment.

MUSCLE TUMORS

Morpurgo[32] described two cases of myoblastoma of the tongue. The first was a small benign lesion (after classification of Abrikossoff) without inflammation of the tongue. The myoblastic cells were found to lie in the connective tissue of the muscle layer and extended into the mucosa up to the epithelial border. The muscle bundles were infiltrated by tumor cells. These cells pushed into the layers of the internal perimysium and produced atrophy and absorption of the striated muscle fibers. In the interstitial tissue about the vessels and nerves, the myoblasts formed thick layers of concentrically or spirally arranged bundles. The individual myoblasts were most often of short, cylindrical, or plump spiral forms with an occasional oval or round cell.

Cappell and Montgomery,[9] in reporting six tumors of striated muscle, discussed the classifications. They proposed two groups, rhabdomyoma and myoblastoma. The former are defined as tumors in which a proportion of cells shows unequivocal transverse and longitudinal striations, the latter as tumors in which the cells resemble muscle cells but are devoid of transverse striations. In this group there were two rhabdomyomas of the soft palate and one myoblastoma of the tongue.

They believe the tongue is one of the most common sites for tumors arising from muscle cells, and emphasize the importance prognostically of differentiation of rhabdomyomas from myoblastomas. The former, growing from a mucous surface, tend to assume a tabulated polypoid form with clubbing of the ends of the processes, and the whole mass is suspended from a narrow pedicle. These tumors have a tendency toward local recurrence in spite of extensive surgical removal and are disseminated through lymphatic channels, in this process, like carcinoma; regional lymph node metastases are, therefore, the risk.

The myoblastomas are generally rounded nodules in the substance of the tongue, only slightly raised above the surface. Local removal may be followed by freedom from recurrence and apparent cure, although examples of malignant nature do occur, as the one case described by the authors.

CONGENITAL LESIONS OF THE TONGUE

Kolesov[29] reported a case of congenital deformity of the tongue and hard palate. The deformity consisted in a cleft in the hard palate and in the tongue, the latter appearing as a double tongue. In addition, there arose foldlike swellings of the gums and of the tongue, which, at the age of 6 months, caused difficulty in breathing and had to be removed.

Proskauer[39] reported a case of congenital cavernous hemangioma of the tongue in a girl 2½ years old. On the basis of this case and previously published observations, the author concludes the importance in treating congenital tumors which may occur in any part of the body. Morphologically benign, these growths may, through their location and growth, become very unpleasant to the individual. This is true especially of hemangiomas of the tongue which are usually small at birth but grow rapidly at intervals. Early treatment is urgent, whether in the form of surgery, chemical means, or some physical agent. Total extirpation is the best but not always feasible choice of removal. Therefore, eradication is tried by ligature, freezing with carbon dioxide, alcohol injection, cauterization, electric needling, and radium irradiation. Often results are obtained only after using various methods at the same time or in rapid succession.

Kindersley[28] reported a large arteriovenous aneurysm, involving the right side of tongue, the floor of the mouth, and the submaxillary area, present since birth. Division of the lingual, facial, and the superior thyroid arteries gave abolition of the thrill which had been present, but, within a few days, the thrill reappeared and the tumor was no smaller in size. A very large sinus ruptured at reoperation, and to control hemorrhage the common carotid was exposed lower in the neck and a tape passed around it. The common carotid was controlled by this means and the pack withdrawn, and no appreciable diminution in the flow of blood was noticed; therefore, the tape was removed and the hemorrhage controlled by a gauze pack. It was presumed, therefore, that some large anastomosis existed with the vessels of the opposite side.

Federspiel[21] reports cases of macroglossia producing abnormalities of occlusion and respiration, and recommends reduction of the size of the tongue by marginal excision around the entire edge rather than V-excision, which may be applied to either lymphatic or muscular hypertrophies. He cautions that occasionally a seeming macroglossia may be due to a dermoid tumor under the tongue.

CHONDROMA OF THE TONGUE

Pless[38] states that chrondromas are common but rarely appear on the tongue. Only eight cases have been reported at the present time, one chondroma occurring at the tip of the tongue; this was described by the author, with three illustrations. There was a walnut-sized pedunculated osteochondroma present

on the tip of the tongue, which was excised in 1934. The origin of this growth was probably attributable to an injury in the form of a tongue bite sustained in 1918.

LIPOMA OF THE TONGUE

Duvoir, Pollet, and Herrenschmidt[18] reported a case of bilateral and symmetrical lipoma of the tongue, and reviewed the literature.

Smith[46] states that lipoma of the tongue is very rare, and reports the successful surgical removal of a huge growth in a woman of fifty-six years.

TUBERCULOSIS OF THE TONGUE

From a clinical point of view, Binstok[3] divides cases of tuberculosis of the tongue into three groups. The first includes patients with a positive sputum in which the tuberculous process is often localized near the tip of the tongue, or at the sides where carious teeth have caused slight abrasions. The ulceration is superficial, spread is by continuity, and the progress of the lesions is relatively slow. When associated with a chronic type of phthisis this form of tuberculosis of the tongue is very amenable to treatment by deep cauterization or local excision of the ulcers. When the ulceration is deep with involvement of the lymphatic glands no surgical treatment should be attempted. In these latter cases the best method of treatment is with x-rays. The second group consists of cases associated with a general dissemination of the tuberculous infection. The lesions begin deep in the substance of the tongue, the infection being deposited there by one of the numerous arteries; the onset is usually sudden. The tongue becomes swollen, but there is no ulceration for a long time; mastication and swallowing become extremely painful. Surgical treatment is contraindicated, and only x-rays and analgesics may be used. If the general resistance is poor such lesions go on to deep ulceration. If the resistance is good a tuberculoma of the tongue forms without ulceration. The third group includes ulcerations near the lingual tonsil, which spread by means of the lymphatics. Such lesions occur in phthisical patients who have undergone operations in the mouth and pharynx, such as tonsillectomy or partial excision of the glottis. The few cases reported in the literature have been treated by applications of carbon dioxide snow, and section of the glossopharyngeal and superior laryngeal nerves to relieve pain. Statistics show that cases of tuberculosis of the tongue form approximately 50 per cent of all the cases of tuberculosis of the mouth cavity.

Martin[31] reports the case of a patient with a lesion that he has called primary tuberculosis of the tongue because in a thorough laboratory and clinical study of the patient no evidence of tuberculosis was found elsewhere.

It is of the utmost importance to have a dark-field examination made of all long-standing ulcers of the tongue to rule out syphilis.

Biopsy should be done in all cases of ulcers or lesions of the tongue of any appreciable duration or size.

If the lesion is tuberculous, a cure can be obtained by excision.

Munro[35] demonstrated five specimens illustrative of the varied manifestations of tuberculous disease of the tongue.

He referred to the comparative infrequency of the condition, but pointed out that it was not unknown for a patient to seek advice on account of a painful ulcer of the tongue, while old-standing pulmonary tuberculosis was overlooked.

In his experience he has never seen a primary case of tuberculous disease of the tongue. All of his patients showed lesions occurring almost as terminal phenomena. No treatment was given.

SYPHILIS OF THE TONGUE

Ramond[41] reports a case of multiple ulceration of the dorsum of the tongue in a patient with a positive Wassermann reaction, pathologic fractures, and Charcot's joint, which was cured with adequate antiluetic treatment.

Tsuzuki[50] found that about 70 per cent of ranula cases are syphilitic; for example, twenty-three of thirty-two cases were proved to be syphilitic by the Wassermann test. Histologically, the syphilitic changes in the cyst wall and the surrounding sublingual glands were seen. Inoculation tests in rabbit testes of cyst walls were positive. Syphilitic ranula cysts can be cured easily by simple drainage of the cysts and the administration of antisyphilitic treatment.

INFECTIOUS PROCESSES

With regard to infectious processes of the tongue, Amit[1] reported fifteen acute inflammations. There were three cases in his series of abscesses at the base of the tongue treated by incision and seven of diffuse inflammation which subsided. He distinguishes between deep phlegmonous infections which require immediate surgical treatment and peritonsillar inflammations which are treated conservatively.

Grigsby and Kaplan[24] conclude from a review of twelve cases that abscess of the tongue requires prompt and adequate incision. Because of the precarious condition of the tissues surrounding the air passages on account of local infiltration, each patient must be carefully examined before the type of anesthesia is chosen. These authors prefer a posterolateral incision because it allows quicker healing and there is less chance of hemorrhage. In the twelve cases reviewed, there were no complications or deaths. In previously reported cases 3 deaths were due to (1) aspiration pneumonia following spontaneous rupture of the abscess, (2) acute edema of the glottis, and (3) hemorrhage.

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Case Reports

This month we have a case report of an osteoma of the mandible sent in by Dr. Messerly of Wheeling, W. Va.

All contributions should be sent to Dr. Kurt H. Thoma, 53 Bay State Road, Boston, Mass.

CASE REPORT NO. 33

OSTEOMA OF THE MANDIBLE

C. D. Messerly, D.D.S., Wheeling, W. Va.

THE patient, Mrs. F. K., a white woman, aged 65 years, complained of an annoyance caused by a hard growth on the lingual surface of the mandible which produced an elevation of the tongue.

History.—Twenty-five years ago while eating a small fish bone penetrated into the gingiva. A physician had to excise some bone in order to remove it. Two years later a hard nodule made its appearance and continued to increase in size, causing discomfort.

Figs. 1 and 2.

Regional Examination.—The mouth was in poor hygienic condition; there were several fixed bridges. All teeth were loose and covered with heavy calcareous deposit; the gingivae were swollen, red, and spongy. A hard tumor

was seen attached to the lingual surface of the mandible extending from the region of the first incisor on the left to the premolar region on the right. It was elevated one-half inch and caused protrusion of the tongue.

Roentgen Examination.—The intraoral film showed a bony tumor. The outline was kidney shaped; it had a fine peripheral cortex and was finely trabeculated, as shown in Fig. 1.

Treatment.—The mouth was placed in a hygienic condition by prophylactic treatment, and for two weeks an astringent mouthwash and hydrogen peroxide were used at home. The operation included the extraction of all the mandibular teeth and excision of the tumor. Under local anesthesia an elliptical incision was made over the tumor at the upper attachment. The mucoperiosteum was detached exposing the bony growth completely. A bone burr was used to remove the growth running it the full length as close to the mandible as possible. After detaching it, it was removed and the surface of the jaw was made smooth with bone files. The alveolar ridge of the entire jaw was then trimmed and the wound closed by suture. A very rapid uneventful recovery was made, and the jaw was soon in condition to receive a denture. The x-ray in Fig. 2 shows the result three weeks after operation.

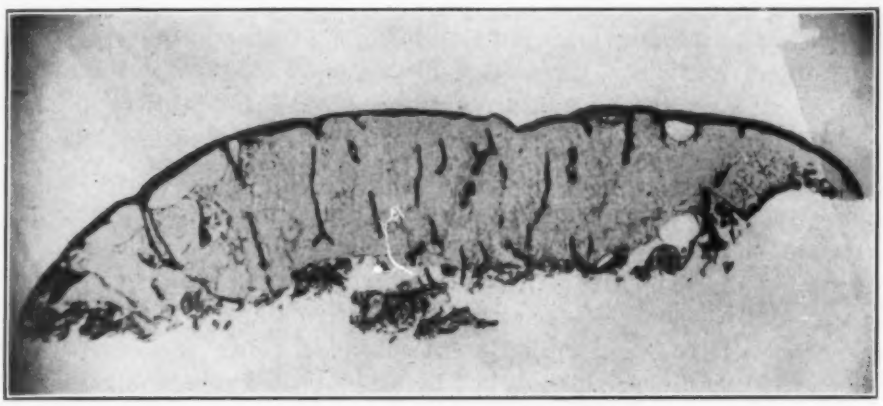

Fig. 3.

Pathologic Examination.—Microscopic examination showed an extremely thin cortex from which extended in radial fashion trabeculae of bone at fairly regular intervals. Scarce branches radiated from these forming an exceedingly wide-meshed spongiosa which contained fatty marrow and only a slight amount of hemopoietic tissue (Fig. 3).

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Indicated and Contra-Indicated Extractions in Orthodontic Therapy: Prof. Dr. Rudolf Schwarz, Chief of the Orthodontic Clinic, Basle, *Ztschr. f. Zähnerzt. Orthopädie. Beilage z. Zahnarzt. Rundschau* **31**: 97-104. June, 1939.

The author differentiates between two types of extractions for the purpose of improving malocclusion of the teeth. One consists of the removal of individual teeth and allowing nature to bring about the improvement through the subsequent drifting of the teeth. The second classification includes those cases in which designated teeth are extracted and orthodontic appliances are employed to guide the malaligned tooth into the space thus created.

We should avoid the extraction of incisor teeth for orthodontic purposes, warns the author, especially in cases with canine teeth in supraversion. Here the adjacent lateral incisor should not be extracted since the result is productive of greater disharmonies. In severely fractured incisors in young children it is occasionally permissible to extract the incisor and resort to orthodontic measures in order to bring the adjacent canine in supraversion to occupy the space. In the mandible the space left by an extracted incisor should never be allowed to close by itself because of the possible resorption of the thin alveolar bone which may lead to subsequent paradontosis. This will not occur in the active closure of the space by means of an appliance.

The extraction of premolars is advocated in cases of crowded anteriors in neutroclusion as well as in distoclusion cases. The author shows illustrations of the following cases in which extraction was performed:

Case 1: Boy, 15 years of age. First premolar extracted and canine in supraversion brought in to occupy the space. The adjacent lateral which was in linguoversion was brought labially, producing an harmonious alignment.

Case 2: Girl, aged 15 years, Class II, division 2 (Angle). Because the relationship of the denture to the face and cranium was in a forward position and would have been aggravated by expansion which is customary in such cases, the author chose for extraction the first premolar on the right side and the second premolar on the left side of the maxilla because they happened to have extensive fillings. Treatment for correction of the anterior teeth was accomplished in seven months. According to the illustrations shown, however, an extensive overbite was still present.

On the basis of his investigations in the field of self-corrections for the past thirty years the author has come to the conclusion that certain cases of distoclusion which he treated by bringing the mandibular teeth forward into a normal occlusal relationship with the maxillary arch would have shown better results if the maxillary first molars had been extracted. His contention is that in those cases where the maxillary arch is in a position of mesial relationship to the cranium, the anterior maxillary teeth remain protruded. Extraction of the maxillary first molars at the proper time, between 11 and 13 years of age, according to Schwarz, when the second molars are erupting, produces a favorable effect by the retraction of the maxillary incisor teeth. The premolars are allowed to drift distally and the erupting second molar is expected to come forward into the place formerly occupied by the first molar.

The spacing in the region of the premolars is considered by Schwarz as an advantage. Besides being prone to caries, the interproximate spaces of the premolars are difficult to reach in patients of this age. Through the spacing the incidence of caries is reduced and, furthermore, the spacings close of themselves as time goes on.

This reviewer has correlated close to 2,000 boys and girls from 15 to 19 years of age, all of whom had one to all four first molars extracted, and has published many findings* which are diametrically opposed to the conclusions of Schwarz.

We shall simply add at this time that the work of the reviewer shows conclusively that the spacing in the premolar region is conducive to caries, traumatic occlusion, and gingival affections. The extraction of first molars as an orthodontic panacea is now generally regarded as being in the realm of empirical diagnosis and treatment. Schwarz's article provides added proof that so-called "clinical observations" are rarely as reliable as scientific correlation.

Chewing as a Technique of Relaxation: By Professor H. L. Hollingworth, *Science* **99**: 385, 1939.

Motor automatisms in great variety have often been explained as "tension outlets." Ties and other accessory movements have been said to be the expression of "inner tensions" or perhaps to be the "symbolic release" of such tensions. Fidgeting, wriggling, pipe smoking, gum chewing, automobiling, and various active sports have received a like extenuation. There has been, however, little precise definition of the character of these alleged "tensions," and experimental evidence of their relief by the collateral activities cited is not abundant.

Without the knowledge of the subjects, special observers watched them throughout the working day and periodically rated each on a scale of motor restlessness. A restless movement was described as any motor activity ir-

*Salzmann, J. A.: Preliminary Report on Tooth Movement After Loss of the First Permanent Molar in 500 Adolescents, INT. J. ORTHODONTICS 23: 662, 1937.

Idem: A Study of Orthodontic and Facial Changes and Effects on Dentition Attending the Loss of First Molars in 500 Adolescents, J. A. D. A. 25: 892, 1938.

Dental Caries, Published by American Dental Association, pp. 141-142, 1939.

relevant to the work being done at the moment. On the whole, decrease of some 10 per cent in restlessness was found while the masticatory is in use.

The workers unanimously report themselves as feeling more relaxed while chewing than when nothing is in the mouth or when a candy wafer is allowed to melt in the mouth.

In so far as fatigue means tension the indication is reduced tension when the masticatory is in use. Tension in the sense of the subjective feeling of strain is reduced from 10 per cent to 15 per cent, while the worker indulges in the collateral chewing movements. Collateral activity as chewing may be carried with no actual cost of effort to the organism, apparently because of the surplus due to reduced motor restlessness.

Perhaps the best meaning of tension is the direct muscular strain existing in parts of the body not immediately occupied with the main occupation. Without exception, in workers during all kinds of work, muscular tension is decreased during the chewing periods. While chewing, parts of the organism not occupied with the main task are appreciably relaxed. The relaxation thus found was greater in the case of the more "tense" of the workers. With the possible exception of work in which a wholly new performance is being learned, chewing while working does not interfere with output. In some kinds of work, especially number checking and typing, the work is positively facilitated.

The suggested effect on new learning (not yet adequately demonstrated) is especially interesting. Some investigators have found that muscular contraction (tension) is an aid in learning tasks. But all of the results show that sustained chewing results in a lowering of tension, however measured.

In two ways they have measured the energy of the movements made in prescribed activities, while the workers were intent only on the accuracy and tempo of their work. In all these cases more energy was put into the activities of the main occupation while chewing.

All these results tell a consistent story. The collateral motor automatism involved in the sustained use of the conventional masticatory does result in a lowering of tension, and the tension thus reduced is muscular. In a sense this is only a confirmation of the testimony of the chronic pipe smoker, whistler, gum chewer, and watch chain twiddler. His statement is likely to be that he does these things when he is "under strain" and that he gets from these collateral activities a "relief from tension."

Perhaps these results also throw some light on the striking fact that during the past ten or more "tense" years the chicle processors have enjoyed their greatest prosperity. The results also suggest techniques which might be put to good use in "relaxation therapy."

In the case of chewing particularly certain other considerations of a somewhat more subtle psychologic type may be relevant. The primary function of chewing is, of course, the mastication of food. Eating is ordinarily a more or less "quiet" occupation. When we eat we sit; random restlessness is at low point; we rest; we relax; and the general feeling tone is likely to be one of agreeableness and satisfaction.

An important item of the eating situation is chewing. It may well enough be that chewing, as a "conditioned stimulus," brings with it, whenever it is sustained, a posture of relaxation. Chewing, in other words, may serve as a reduced cue and in some degree redintegrate the relaxation of mealtime.

The Supplementary Value of the Banana in Institution Diets: I. Effect on Growth in Height and Weight, Ossification of Carpals, and Changes in Franzen Indices. By Lydia J. Roberts, Ph.D., Ruth Blair, Gertrude Austin, and Grace Steininger. II. Capillary Resistance and Reduced Ascorbic Acid in the Blood Plasma. Lydia J. Roberts, Ph.D., Margaret H. Brookes, Ph.D., Ruth Blair, Gertrude Austin, and Isable Nobel, Ph.D. *The Journal of Pediatrics* **15**: 25, 1939.

Daily addition of two or three bananas to a reasonably adequate diet indicated distinct advantage. The experimental set made somewhat greater gain in weight and height, greater progress in bone ossification (Carter Index), greater increase in measurement of arm girth and subcutaneous tissue (Franzen Indices), greater improvement in capillary resistance and higher level of vitamin C (reduced ascorbic acid). Differences did not always attain theoretical statistical significance. However, the fact that the tests were made on matched groups of boys ranging from 8 to 16 years of age, living in institutional cottages under the care of matrons and that the results "are consistent in direction lends support to the belief that the differences are real ones attributable to the supplement."

Frances Krasnow, Ph.D.

Thumb- and Finger-Sucking in Childhood: William S. Langford, M.D., *J. Pediatrics* **15**: 459, 1939.

Finger-sucking is important to the pediatrician because of the concern it causes parents. The pediatrician is often at a loss for advice to give regarding the occurrence of this symptom in children. He, too, is confused by the mass of conflicting ideas as to its harmfulness. This common symptom of childhood has been blamed for various deformities of the face, teeth, and hands. The alarmists, not content with these local "bad" effects, have maintained that finger-sucking is a contributory cause of diseased tonsils and adenoids and also of gastrointestinal disorders through the ingestion of bacteria or as a result of an inability to masticate food properly because of the dental malocclusion. No evidence is offered for the latter ill effects. Children who suck their fingers are not any more susceptible to digestive disorders than those who do not. The only scientific evidence regarding the production of facial deformities is offered by Lewis, who has shown that if a malocclusion does occur, it will spontaneously correct itself if the sucking disappears before the eruption of the permanent teeth.

There is no evidence to show that thumb-sucking leads to masturbation or is a "sexual" activity in terms of adult genital sexuality. It is pleasurable, yet, as Thom says, if this means it is a sexual activity, so is head scratching.

Sucking of the thumb or fingers occurs in practically every child during the first year of life, especially when hungry. During the normal period of hand-to-mouth reaction in the middle and latter months of the first year, it occurs as a result of the sucking reflex. It seems to be increased during teething. In a well-fed, happy infant there should be no cause for alarm. There is little to be gained by restraints during the first year, and later they are definitely contraindicated.

After infancy, during the preschool years, the symptom is frequently seen associated with fatigue, boredom, illness, punishment, and frustrating situations. Treatment should be directed toward dealing with any distinct causes of emotional dissatisfaction and keeping the child reasonably well occupied.

In older children the danger of deformity is greater. Here the symptom is but a part manifestation of a general emotional immaturity which should not be viewed casually. These children call for careful study and an adequate broad program of personality and environmental readjustment.

There is little cause for alarm over this symptom in early childhood. The pediatrician should help reassure the parents and aid them in avoiding the often harmful battle which ensues when they try to "break the habit." This power contest seems only to intensify the difficulty.

Book Reviews

Textbook of General Surgery: By Warren H. Cole, M.D., F.A.C.S., Professor of Surgery, University of Illinois College of Medicine. Formerly Associate Professor of Surgery, Washington University School of Medicine, St. Louis, Ed. 2, Price $8.00, New York, 1939, pp. 1031, D. Appleton-Century Co.

The many changes in the second edition, prepared only three years after the first, have greatly added to the value of this textbook. The authors have succeeded in bringing the many advances in surgical therapy to the attention of the readers, namely medical students and general practitioners, for whom this book is intended. A clear and concise picture of the physiology, surgical pathology, and therapy of the conditions discussed is afforded by the excellent manner in which the material is presented. Details of surgical technique which are beyond the scope of a textbook of this kind are wisely reduced to a minimum. The newer aspects of physiology which form the basis of proper preoperative preparation of the patient as well as correct evaluation and treatment of postoperative complications have been adequately stressed.

The more common diseases of the oral cavity are fully discussed within the limits of the intended scope of the book. Cognizance has been taken of the newer weapons at the disposal of the surgeon, such as sulfanilamide, vitamin K; the Miller and Abbott tube, the Wangensteen decompression apparatus, and Pavaex therapy.

The photographs with their excellent captions, and the photomicrographs and roentgenographs with which the book is richly illustrated are of great value in elucidating the text. The approach of the authors to their task has

been guided throughout by the purpose of presenting a book which should hold the lively interest of the reader and make the newer conceptions of surgical physiology and therapy available to the general practitioner.

H. A. Salzmann, M.D., F.A.C.S.

Textbook of Pathology: A Correlation of Clinical Observations and Pathological Findings. By Charles W. Duval, M.D., Professor of Pathology and Bacteriology, Tulane University School of Medicine; Chief Visiting Pathologist, Charity Hospital, New Orleans; Consultant in Pathology, Touro Infirmary, New Orleans, and Herbert J. Schattenberg, M.D., Associate Professor of Pathology and Bacteriology, Tulane University School of Medicine, Visiting Pathologist Charity Hospital, New Orleans. Illustrated, Pp. 681. Cloth, Price $8.50. New York, 1939, D. Appleton-Century Co.

The attempt is made here to stress the relationship between pathologic physiology and morbid anatomy. With this viewpoint as their premise, the authors stress the pathology of the living patient rather than the morbid changes to be found in the cadaver. References are confined mainly to articles written in the English language, and the student is encouraged to seek the sources of the various topics discussed.

Disease processes as exudation, proliferation, and degeneration are discussed as to their nature and manifestation. Of especial interest will be the detailed chapter on "Diseases of the Hematopoietic System." The various blood dyscrasias have been receiving increased attention from the oral surgeons and those interested in the treatment of oral pathology. Diseases of the osseous system have long found discussion in dental literature. These are presented here in detail. The book is excellently illustrated throughout and a complete index is provided.

Gross Anatomy: A Brief Presentation of the Macroscopic Structure of the Human Body. By A. Brazier Howell, Associate Professor of Anatomy, Johns Hopkins University School of Medicine. Illustrated. Cloth, Price $6.00. New York, 1939, D. Appleton-Century Co.

Because of the curtailment of time allotted to this subject in medical schools, the author found it worth while to write the present volume in order to present the essentials of human anatomy in a coordinated manner. Orthodontists will find the chapters on general development, the skull, and the muscular system extremely helpful.

This volume does not go into detail when dealing with muscles but gives a direct statement on the location, source, insertion, action, and innervation that is easy to follow. The practitioner will find the explanations relative to the terminology of interest. At present there are three terminologies used interchangeably: the basic, the comparative anatomy, and that in human anatomy. Howell finds the Latin terminology of the Basle Anatomical Nomenclature (B.N.A.) cumbersome and frequently uses English equivalents. The book has a good index.

Editorials

School Hours and Professional Service for School Children

INASMUCH as orthodontists spend their lives, for the most part, working with children of school age, they have an opportunity to observe the habits and thought patterns of modern childhood that very few enjoy. Who is there who knows any better of the injustice and even hardship that is worked upon children suffering from physical handicaps by the regimentation and ironclad rules set up by modern school systems in the cause of education of the youth?

Talk to many professional men, medical or dental, whose work brings them in contact, day by day, with modern children between the ages of 7 and 14 years; many of them will tell you that the modern tempo of pedagogic life, as applied to childhood, has grown entirely too strenuous and top-heavy for the best physical and healthful development of the child. They will tell you that as the result of restrictions and the highly competitive system of scholastics, mental inflation is being much overemphasized to the detriment, in many instances, of the physical welfare of the individual child.

The pedagogues answer that observation by pointing with pride to elaborate physical education set-ups, including programs of competitive athletics, coaches, physical instructors, athletic fields, etc., and that is no doubt as it should be. However, what they do not seem to comprehend is that exercise and athletics are only one leg of a many-legged stool that supports the physical make-up of the human body. They do not seem to understand that a child with a foot turned in, chronic sinus, malocclusion, or one of many defects equally important, should have these things corrected first and school should come second if there must be a choice in their degree of importance along the journey to manhood or womanhood.

Present a child with a physical defect that requires long and systematic treatment in order to effect a cure; the mother and doctor are then promptly confronted with the major problem of accomplishing such treatment, realizing that the time involved and appointments necessary to make such a correction are in violent conflict with his school program. Such a situation resolves itself for the mother and doctor into a problem something like this. The doctor knows he must conduct his treatment for the most part on Saturday mornings and in the late afternoon on weekdays, outside of school hours. If the expectancy of risk in treatment is long and tedious, he is inclined to back off, realizing that the risk of success or failure is highly speculative on account of the conflict of time and restrictions of school rules. The mother finds herself between two fires—the doctor who has little tolerance for pedagogic resistance when important physical matters are involved and the schools whose authorities seem to regard appointments with physicians and dentists as nuisances insofar as they conflict with school routine.

The private school problem has become a major one for most orthodontists particularly, because the above conditions are still more intensified in private institutions. Many of these institutions keep their students busy either at school work or at athletics until five o'clock in the evening of each day. For an orthodontist to secure the results he would like to get with this kind of a "stop watch" applied to his efforts is a handicap that few realize as well as the man who is to do the work.

As for military schools, the program of some of them, at least, as regards students keeping appointments, particularly with orthodontists, is so severe that, in the past, many busy orthodontists have been compelled to make it plain that they are unable to assume responsibility of treatment of students under such rigid regime. The result of this, insofar as the student is concerned, is that he has been placed in the hands of practitioners with limited experience or in the care of someone who will "follow orders" from the military school in question. On the other hand, some military schools regard orthodontic treatment as such a nuisance, as it conflicts with the student's routine program, that orthodontists have learned that attendance of their patient at such schools during treatment carries with it a high mortality rate insofar as failure of treatment is concerned. There are schools, however, and good ones too, which do tolerate physical routine appointments with doctors. In the main there is great need for improvement in this unfortunate condition, for the best interests of children.

In any event, now, after long years of school authorities becoming increasingly adamant in their restrictions pertaining to this subject, there is a light on the horizon on the West Coast that offers some solace for the future. A bill was introduced in the 1935 session of the legislature of the State of California that proposed that children may be excused from school for bona fide medical and dental appointments without penalty to the child, or without such absences serving to detract from the amount of the school budget.

The bill is now a law in California, but it was secured with difficulty. It passed the Assembly, but was killed in the Senate Committee by opposition of the State Department of Education. So great was the interest of dentists, parents, and many school officials throughout the state that the bill was again introduced this year. It passed the Assembly unanimously, and again met bitter opposition in the Senate. Two committee hearings were necessary before the bill was sent to the floor of the Senate for final vote. Representatives of the Department of Education and the California State Teachers' Association, it is said, opposed the measure on the presumption that it set a bad precedent. Strong pressure was brought to bear in an attempt to defeat the bill on the floor of the Senate, but so great was the demand from organized dentistry and from the lay public, through efforts of local groups of the Public Health League, that it passed the Senate on June 9, 1939.

The text of the bill follows: No absence of a pupil from school for the purpose of having dental service rendered shall be deemed an absence in computing average daily attendance.

Men practicing dentistry and medicine everywhere hope that the time is not remote when each and every state in America will enjoy like legislation, so that children will not suffer the penalty of slapstick and hurried service, due to

an overcrowded practice between the hours of three and five o'clock every day, and so that they can appraise prospective treatment for a child without being compelled mentally to discount in advance the query, "How much will school rules pertaining to absence of pupils increase the risk of ultimate success in this case?"

California has paved the way for much needed constructive legislation for the benefit of childhood and has broken down great pedagogic resistance to treatment of physical defects in children of school age. School conflict may also be somewhat responsible for much of the so-called high cost of professional care as applied to children, because it has placed a premium on time after school and on Saturday morning. There is not much point in promoting great dental care programs for children of school age until there is time available for the dentist to do such work other than "after school"—the nightmare of all busy professional men who work with children. California professional men are to be congratulated for their part in bringing about such a constructive piece of legislation.

H. C. P.

Public Relations

THUMB through the advertising text that is directed to the dental profession pertaining to orthodontic practice; read current articles printed in dental journals that are of the type in which the author usually points out that he "treats only a few of the simpler cases in which the patient cannot afford a specialist"; talk to laymen and educators anywhere, and you are promptly confronted with the indisputable fact that both the practice of orthodontics and the ability and training of those who practice it are akin to a problem child in dentistry. What, if anything, is to be done about it by the profession itself?

A part of the answer to the problem may be the activities of the Public Relations Bureau of the American Association of Orthodontists. This Bureau issued its Bulletin No. 1, Oct. 1, 1939, and it was sent to the entire membership of the American Association of Orthodontists for their information and perusal.

Along with the Bulletin there was enclosed a copy of the article entitled "Make Way for Even Teeth," which was reprinted from the *Parents' Magazine* of September, 1939, at the request of the committee of the American Association of Orthodontists. The Public Relations Bureau also sent a letter with the first issue of the Bulletin indicating that a great task is ahead for the committee and that in accomplishing their purposes the committee asks for the enthusiastic cooperation of the entire membership of the American Association of Orthodontists. It was pointed out in the letter that there is a way to use the reprint from *Parents' Magazine*. For instance, it was suggested that the idea, or blueprint, of the entire plan depends upon orthodontists making direct contacts with key persons to whom the public turns for advice in matters pertaining to health education.

The committee proposes that constituent societies, or possibly members, acting on their own initiative bring the reprint to the attention of persons af-

filiated with various school and health groups: health officers, public health nurses, school administration authorities, child psychologists, etc.

The committee points out that it desires that the entire membership of the American Association of Orthodontists cooperate and provide all the contacts possible for the education, guidance, and even protection of the public in this work. It is noted by the Bureau that orthodontics is a health service of indispensable value when its proper standards are upheld, and that its value should be brought to the attention of the public at large, in order to gain the prestige it deserves.

The activities of the Public Relations Bureau of the American Association of Orthodontists now initiate the first organized effort that has ever been made to call attention of educators, health authorities, the medical profession, and the public to the end results of competent orthodontic practice. This effort has been in the making for several years and represents a tremendous amount of work on the part of the Chairman, along with those who have been willing to sacrifice time and money for the purpose of extending the orthodontic field and service, with the thought in view that such efforts assist in making orthodontics an important department of all public health service.

It has been felt by many for some time that orthodontic practice has now emerged far beyond the experimental stage and that it needs careful guidance in its future trends. Obviously, one of the most valuable and constructive contributions that can now be made to the future is that the Public Relations Bureau of the American Association of Orthodontists enjoys the full cooperation of orthodontists everywhere in the highly meritorious effort that they are now engaged in. If this cooperation is wholesomely contributed, it is reasonable to assume that a few years will see orthodontics emerge into the limelight of one of the most highly regarded health services possible in child welfare.

The subject has an important record of achievement and advance behind it like the subjects of pediatrics and orthopedics. In medicine, however, it is no secret that the public and even the professions, including many of the dental professions, are not familiar with the strides the subject has made. It is thought that the Public Relations Bureau, which has made such a magnificent start, will assist in carrying the message of orthodontic achievement and purpose and ideals to those who would most benefit by such information.

For the benefit of the readers of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY, the JOURNAL herewith lists the officers of the Bureau as now organized. The Executive Committee consists of T. W. Sorrels, chairman, George A. Barker, and Frank Nicolai; the Board of Directors are Frank Nicolai, chairman, Norman L. Hillyer, Henry U. Barber, Joseph D. Eby, Sidney E. Riesner, J. A. Salzmann, Leuman M. Waugh, and Glenn F. Young. The Director is Mr. Dwight Anderson, 2 East 103rd Street, New York City.

When orthodontists collectively understand that the American Association of Orthodontists has made a liberal appropriation of funds for the promotion of this work, and when it is realized that efforts are being made unselfishly by this committee for the purpose in hand, then will the work and its appreciation by the public as a service for children come into its own.

H. C. P.

In Memoriam

Harry L. Morehouse

Dr. Harry L. Morehouse, one of the early specialists in orthodontics, practiced in Spokane, Wash., for thirty-two years. He passed away rather suddenly at the age of 64 years, after having spent a busy life, mostly practicing orthodontics. His motto was, "He profits most who serves life best." He lived joyously, was full of cheer, and found pleasure in his work. Many youths of his home city came under his care during his long period of active service in order to have him relieve their physical defects.

He was a member of Delta Sigma Delta, the Spokane Dental Society, the Washington Dental Society, the American Dental Association, the Pacific Coast Society and the American Association of Orthodontists. He was President of the Spokane District Dental Society and a graduate of the Angle School of Orthodontia, St. Louis, Mo., in 1907. Dr. Morehouse was awarded the Certificate of the American Board of Orthodontics in 1930.

Harry Morehouse was born in Ypsilanti, Mich. He attended Grinnell College in Iowa and was graduated from the University of Pennsylvania College of Dentistry. He also practiced for a very short time, early in his career, in Colorado Springs, Colo.

Dr. Morehouse will be remembered and respected among the early pioneers of orthodontics as a religious, energetic, and tireless worker for the improvement of practice, and a vigorous contributor to the advancement of the specialty. Another man who helped clear the path of orthodontics has gone to his reward, and he has left an imprint that will live on to the credit of the specialty.

News and Notes

American Association of Orthodontists

The Thirty-Eighth Annual Meeting of the American Association of Orthodontists will be held in Chicago, Ill., May 13 to 16, 1940, at the Edgewater Beach Hotel. All ethical members of the dental profession are invited.

CLAUDE R. WOOD, Secretary-Treasurer,
608 Medical Arts Building,
Knoxville, Tenn.

Awarded Certificates of Proficiency in Orthodontics

The following have been awarded the Certificate of Proficiency in Orthodontics by Columbia University during the past year:

Name and Address	Dental Degree From:
Dr. John Dolce, Bronx, N. Y.	Columbia University
Dr. Joseph Gould, Cleveland, Ohio	Western Reserve University
Dr. Raymond Grace, East Orange, N. J.	University of Maryland
Dr. Harley G. Kushel, Rochester, N. Y.	Dalhousie University, Halifax
Dr. Louis P. Lepine, Montreal, Can.	University of Montreal
Dr. Harold Leslie, Toronto, Can.	University of Toronto
Dr. Joseph T. Marder, New York City	College of Dental and Oral Surgery of New York
Dr. Vincent P. Marran, Holyoke, Mass.	Harvard University
Dr. John Mayers, New York City	Columbia University
Dr. Walter A. H. Mosmann, North Bergen, N. J.	Northwestern University
Dr. Wilbur Prezzano, White Plains, N. Y.	Columbia University
Dr. Herman Rodnick, New York City	College of Dental and Oral Surgery of New York
Dr. John Sage, Flushing, N. Y.	Tufts College
Dr. Bernard H. Schanbam, Jersey City, N. J.	Northwestern University
Dr. Henry Spiller, Buffalo, N. Y.	University of Buffalo
Dr. Maurice Stavin, New York City	Columbia University
Dr. Leo Wagner, New York City	Columbia University
Dr. Donald B. Waugh, New York City	Columbia University

The Journal will publish the names of bona fide graduates of graduate schools of orthodontics that are connected with universities and who have completed courses of a year's or more duration.

Dr. James David McCoy Honored

Of news interest to orthodontists is the fact that the year book of the Southern California State Dental Association, just off the press, has honored a past-president of the American Association of Orthodontists.

Carrying a picture of Dr. James David McCoy on its frontispiece, the year book dedicates the issue to him, with the following legend, "To James David McCoy, whose professional activities and attainment have brought national honor and distinction to dentistry in Southern California, this volume is respectfully dedicated."

The year book of the Southern California State Dental Association is issued annually at the time of the meeting of the State Dental Society. It contains the program of the current meeting along with other interesting facts and items pertaining to the past year of dentistry in Southern California.

Dental Educational Films

Few have done more with modern visual dental educational programs, by the use of moving pictures, than has Dr. David Bennett Hill of Salem, Ore.

It will be remembered that Dr. Hill's picture, the "Life of a Healthy Child," gained wide recognition in educational circles throughout the country. A number of films, which have been prepared by Dr. Hill, are available for dental educational groups. Some of the films have been shown by the Public Relations Committee at the American Dental Association National Convention in St. Louis before health groups consisting of health workers from various parts of the country. These health films were shown in the Auditorium each morning and afternoon; they were shown also to large groups of school children.

A synopsis of the most recent releases of Dr. Hill's work is as follows:

"Prenatal Care."—One reel, 450 feet, 16 mm. silent with lecture and guide, sound-on-film with narrator; illustrates health activities and prenatal care, correct diet, exercise, rest, regular physical examination and care of the teeth, body and general health.

"Mother and Child From Birth to One Year of Age."—One reel, 450 feet, 16 mm. silent with lecture and guide, sound-on-film with narrator; illustrates health activities of the mother and child from birth to one year of age; mother's care, diet, exercise, cleaniness, etc., baby's regular daily schedule, preparation of food, sterilization of food containers, etc., exercise, habit training, and medical and dental supervision.

"Child From One to Six."—Two reels, 750 feet, silent with lecture and guide, sound-on-film with narrator; illustrates activities of the normal child from one to six years of age; correct diet, habits, play that develops the mind and the muscles, cleanliness, care of the teeth and body, visits to the doctor and dentist, emphasizing deformed faces and irregular teeth, a few of the habits causing these deformities and recommending early treatment, safety first, sexual advice by the parents.

Chicago Association of Orthodontists

The Chicago Association of Orthodontists will meet Monday evening, Jan. 29, 1940, at the Palmer House. Dr. Wm. G. Skillen of Northwestern University Dental School will speak on "Tissue Changes Incident to Orthodontic Rotation Movement."

Southwestern Society of Orthodontists

The Nineteenth Annual Meeting of the Southwestern Society of Orthodontists will be held at the Rice Hotel, Houston, Texas, Feb. 18 to 21, 1940.

R. E. Olson, Secretary-Treasurer
1001 Union Nat'l. Bank Bldg.
Wichita, Kan.

Examination for Dental Internship

The Bronx Hospital examination for dental internship will be held on Tuesday, Dec. 26, 1939, at 8:00 P.M. at the Bronx Hospital, Fulton Avenue at 169th Street, Bronx, N. Y. This internship is for a period of one year beginning July 1, 1940.

Post-Graduate Seminar in Children's Dentistry

A fifteen weeks Post-Graduate Seminar in children's dentistry, sponsored by the Tennessee State Dental Association, and the Tennessee State Department of Public Health, has just been completed. This course, which is one of the most extensive undertaken by any state, was enthusiastically received and well attended. Approximately four hundred and twenty-five dentists registered for the course.

Five weeks were devoted to each of three districts for a total program duration of fifteen weeks. Each district was subdivided into three district centers where the series of five lecture-clinics were held on Mondays, Wednesdays and Fridays, respectively.

Each class period consisted of lectures from 10:00 A.M. until 12:00. Following a recess of one hour for luncheon the class assembled for open discussion and table clinics until 3:00 P.M. The remainder of the afternoon and the following morning were devoted to office consultation and chair demonstrations.

Dr. Ralph L. Ireland, professor of Children's Dentistry at the University of Nebraska College of Dentistry, was the instructor for the course, and he was assisted by Dr. Walter J. Pelton, Passed Assistant Dental Surgeon of the United States Public Health Service.

Southern Dental Association

The Southern Dental Association will hold its annual meeting in Chattanooga, Tenn., on Feb. 5 and 6, 1940, at the Hotel Patten.

Notes of Interest

Dr. Leuman M. Waugh takes pleasure in announcing that his son, Dr. Donald B. Waugh, has become associated with him in the practice of orthodontics, 576 Fifth Avenue, New York.

Dr. Frederick Barich announces the removal of his office to Suite 510, 636 Church Street, Evanston, Ill. Practice limited to orthodontics.

Dr. Walter T. McFall announces the opening of his office at 602 Flatiron Building, Asheville, N. C., for the exclusive practice of orthodontics. Dr. McFall succeeds Dr. Louis Mann, who is retiring from practice in Asheville.

Dr. John Mason Griffin announces that he has taken over the orthodontic practice of the late Dr. J. Howard Furby at 201 North El Molino Avenue, Pasadena, Calif. Dr. Griffin still maintains his orthodontic practice and office at 509 Hollywood Security Bank Building, Hollywood, Calif.

Dr. Curtis L. Benight of Denver, Colo., announces that he has continued the practice of Dr. Fred W. Beesley, who has retired. Practice limited to orthodontics.

Dr. Harvey M. Spears of Santa Ana, Calif., has been elected vice-president of the Southern California State Dental Association.

Dr. Samuel J. Lewis, 308 David Whitney Building, Detroit, Mich., announces the association of Dr. Robert E. Coleman in the practice of orthodontics.

Dr. Virginia Garth Trembly announces the removal of her offices from 317 Burns Building to 607 Exchange National Bank Building, Colorado Springs, Colo.

Dr. Harvey M. Spears, Santa Ana, Calif., announces that he has succeeded Dr. W. D. Bedford for part-time practice in Fullerton, Calif. Practice limited to orthodontics.

Dr. Frederick M. Epley, Flood Building, San Francisco, Calif., announces that he is continuing the practice of his late father, Dr. Francis W. Epley. Practice limited to orthodontics.

Dr. Jack H. Taylor, orthodontist, announces his association with James O. Lindsey, M.D., 1011 Bay Cities Building, Santa Monica, Calif.

Dr. Vincent P. Marran announces that on Dec. 1, 1939, he will open an office for the exclusive practice of orthodontics in Suite 7, 4 Chestnut Street, Springfield, Mass.

Dr. John A. Rowe announces Dr. Leslie G. Dick as his associate in the practice of orthodontics, Medical Arts Building, San Antonio, Texas.

Dr. E. C. Lunsford and Dr. W. A. Buhner of Miami, Fla., announce that they have moved their offices from the Huntington Building to 2742 Biscayne Blvd. Practice limited to orthodontics.

Dr. Frank B. Truesdell, formerly associated with his father, Dr. Blaine Truesdell, in Omaha, Neb., has opened an office in the Franklin Building, Richmond, Va., where he will engage in the practice of orthodontics.

Dr. A. K. Toepfer announces the removal of his office from 741 David Whitney Building, Detroit, Mich., to 201 National Bank Building, Birmingham, Mich. Practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES*

American Association of Orthodontists

President, William A. Murray - - - - - - - - - - - - - - - - - - Evanston, Ill.
Secretary-Treasurer, Claude R. Wood - - - - - - - - - - - - - Knoxville, Tenn.

Central Association of Orthodontists

President, Max E. Ernst - St. Paul, Minn.
Secretary-Treasurer, L. B. Higley - - - - - - - - - - - - - - - Iowa City, Iowa

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President, Harvey G. Bean - - - - - - - - - - - - - - - - - - - Toronto, Can.
Secretary-Treasurer, Richard E. Barnes - - - - - - - - - - - - Cleveland, Ohio

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Secretary-Treasurer, Edward I. Silver - - - - - - - - - - - - - Boston, Mass.

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Secretary-Treasurer, William C. Keller - - - - - - - - - - - - New York, N. Y.

Rocky Mountain Society of Orthodontists

President, Leonard T. Walsh - - - - - - - - - - - - - - - - - - Pueblo, Colo.
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Southern Society of Orthodontists

President, A. C. Broussard - - - - - - - - - - - - - - - - - - New Orleans, La.
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President, J. H. Weaver - Houston, Texas
Secretary-Treasurer, R. E. Olson - - - - - - - - - - - - - - - - Wichita, Kan.

Pacific Coast Society of Orthodontists

President, Will G. Sheffer - - - - - - - - - - - - - - - - - - - San Jose, Calif.
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British Society for the Study of Orthodontics

President, S. A. Riddett
Secretary, R. Cutler
Treasurer, H. R. Evans

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*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

†The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis, Mo., U. S. A.

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ANOTHER milestone passed and an open road, full of promise, stretching away to new horizons is beckoning ahead. May your Christmas be all that Christmas Day should be and the travel smooth in 1940, so that when another New Year's Day dawns, the twelvemonth, then just passed, will linger as a never-to-be-forgotten time of happiness and prosperity.

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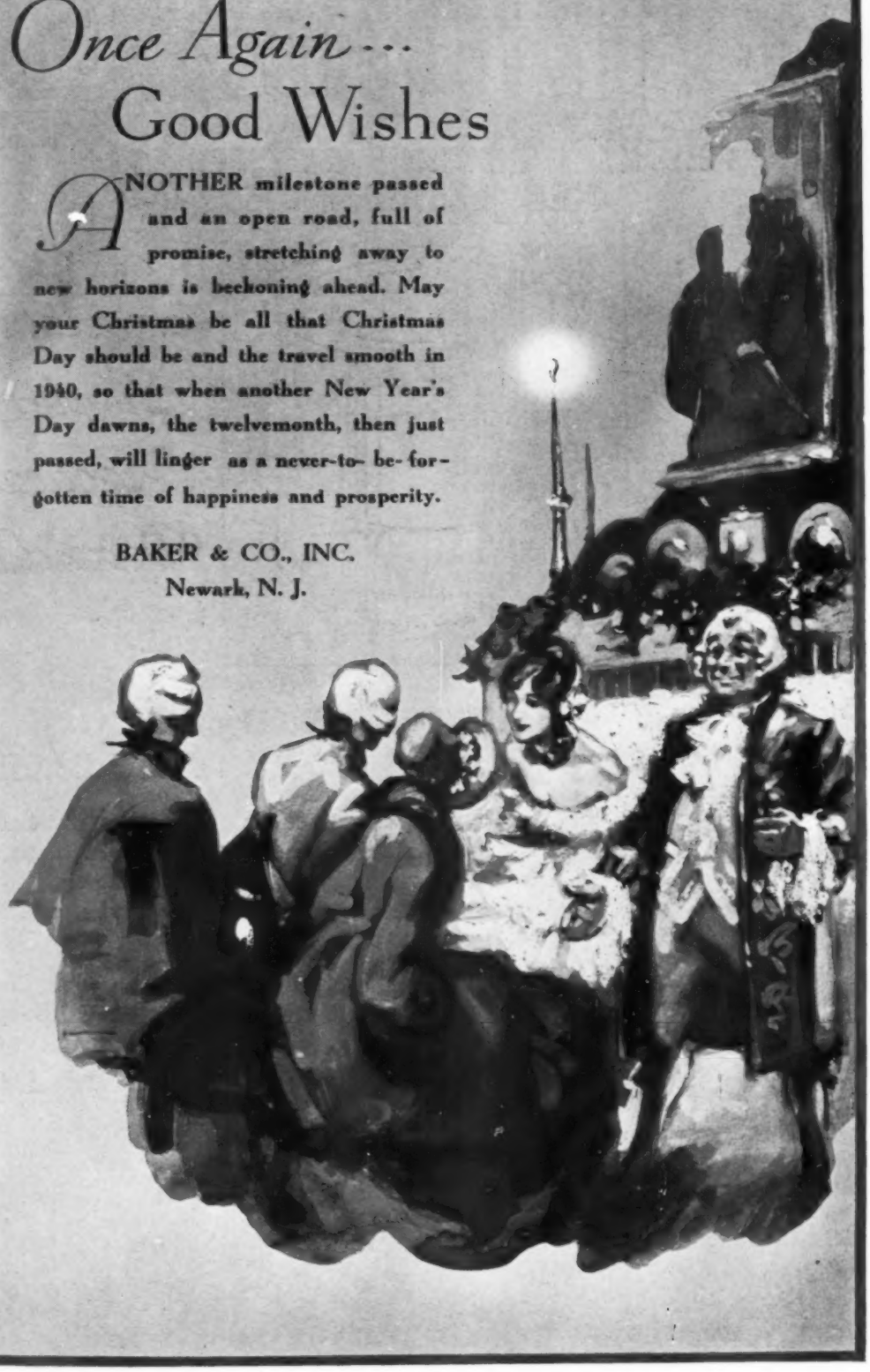

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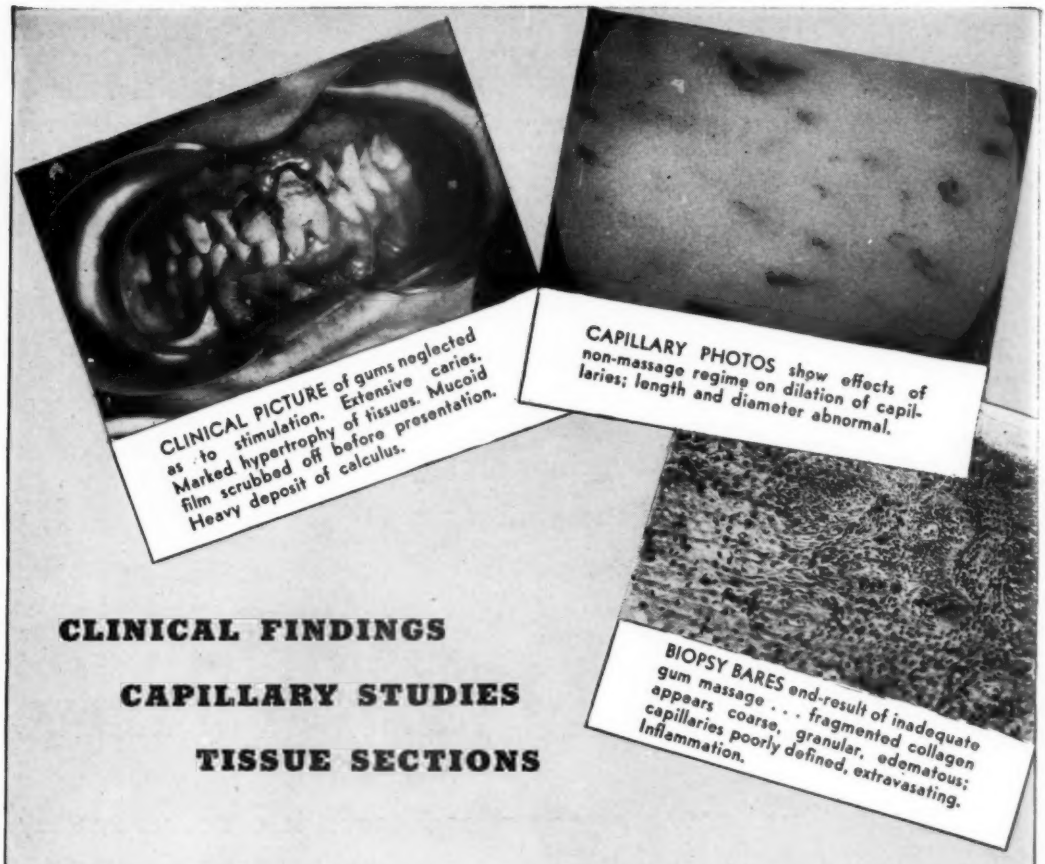

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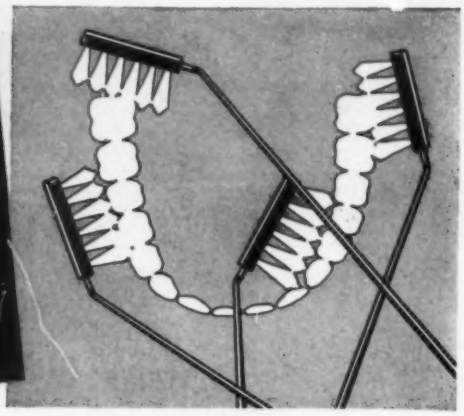

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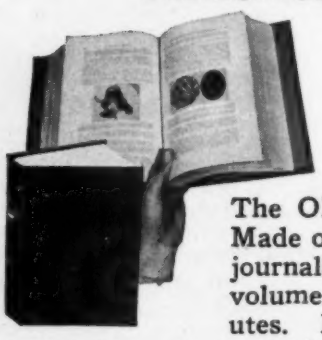

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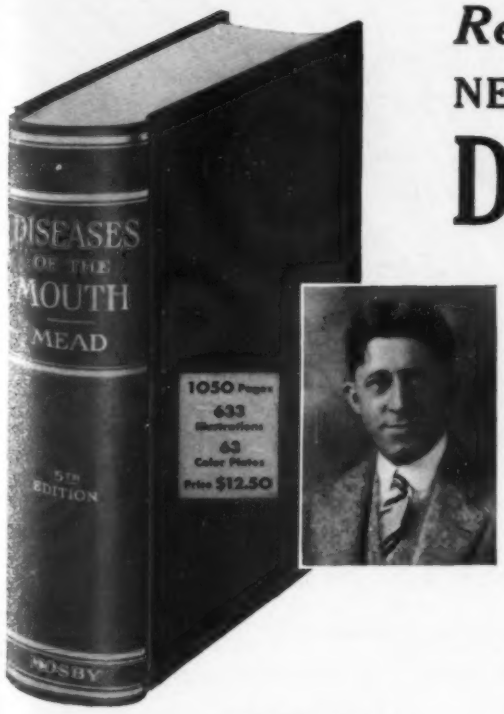

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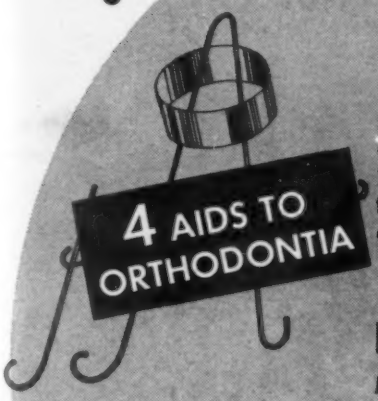

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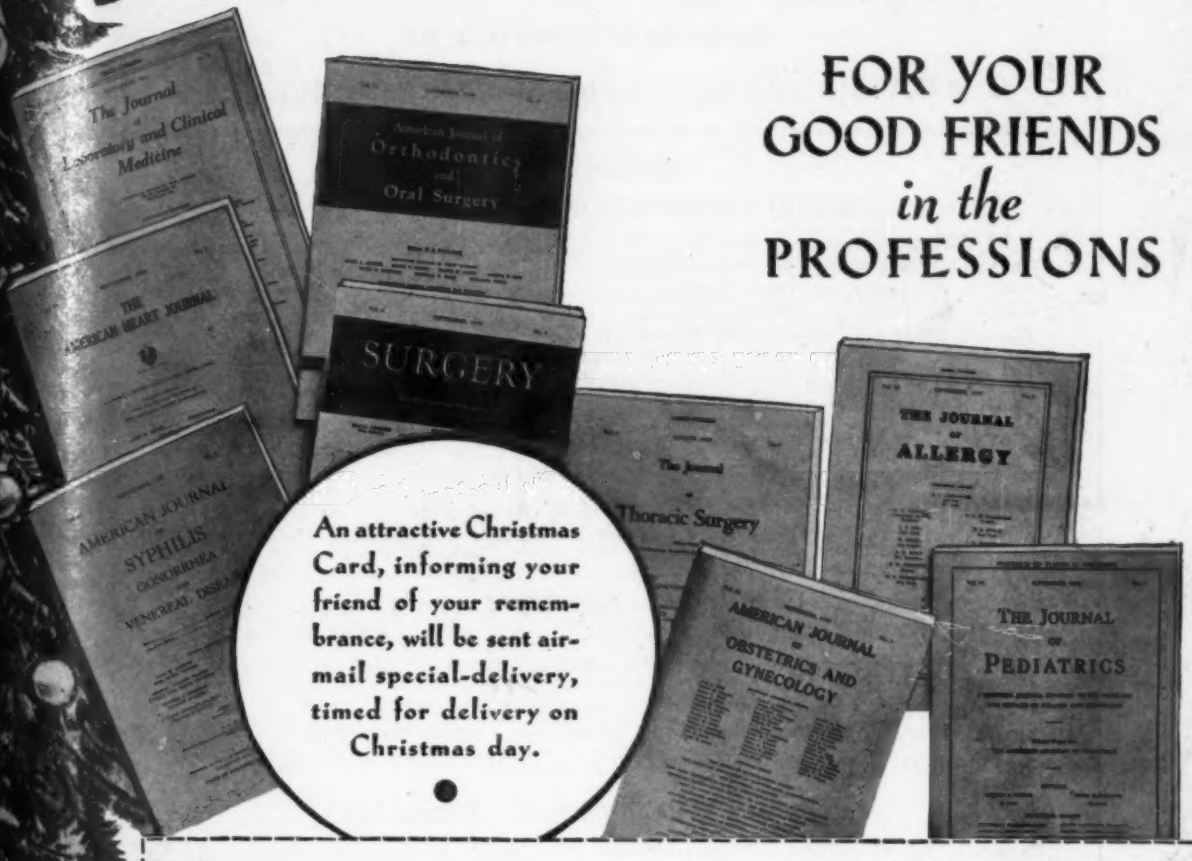
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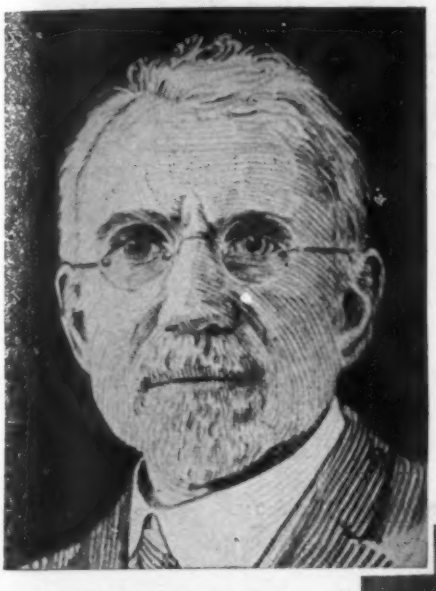

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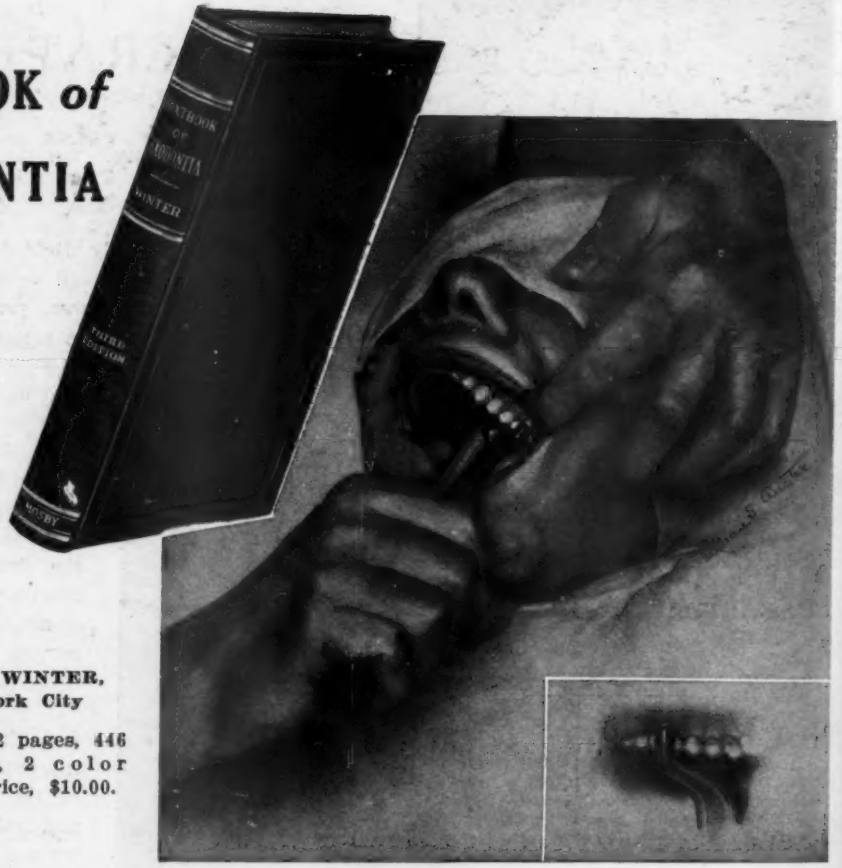

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